A SHIFTING PARADIGM: TEACHERS' BELIEFS AND METHODS FOR FOSTERING ECOLOGICAL LITERACY IN TWO PUBLIC CHARTER SCHOOLS

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A

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Abstract

Ecological literacy is measured by a person's ability to understand the natural systems that make life on earth possible and how to live in accordance with those systems. The emergence of the pedagogies of place- and community-based education during the past two decades provides a possible avenue for fostering ecological literacy in schools. This thesis explores the following research questions: 1) How is ecological literacy fostered in two Alaskan public charter schools? 2) What are teachers' beliefs in these two schools about the way children and youth develop ecological literacy? 3) What are effective teaching methods and what are the challenges in engaging students in ecological literacy? Semi-structured interviews were conducted with six K-12 teachers in two public charter schools in Alaska in order to investigate these questions, and relevant examples of student work were collected for study as well. Qualitative data analysis revealed several emergent themes: the need for real-world connections to curriculum; the necessity of time spent outdoors at a young age; the long-term and holistic nature of ecological literacy development; and the importance of family and community role models in developing connections with the natural world. Based upon the research findings, several recommendations are made to support the efforts of teachers in these schools and elsewhere for fostering ecological literacy in children and youth.

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Acknowledgements

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I am indebted to the classroom teachers who graciously volunteered their time to participate in this study. The deep and thoughtful insights that they provided into the practical nature of ecological literacy as it plays out every day in their classrooms were invaluable. I hope that I was able to return at least a fraction of what they shared by providing a safe space in which to reflect on their practices and to receive reassuring feedback of their excellent work.

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Finally, I would like to express my love and appreciation for my family, especially my partner Shannon for sticking with me always, even when it became tiring hearing about the same topic day in and day out. To my parents, I thank them for supporting me throughout my life and teaching me from an early age that I could do anything I wanted.

Chapter One: Introduction

Statement of the Problem

David Orr (1992) describes ecological literacy as "a broad understanding of how people and societies relate to each other and to natural systems, and how they might do so sustainably" (p. 92). According to Orr and numerous others writing throughout the past several decades, the general public has moved further and further away from being ecologically literate (Caduto, 1998; Cajete, 1999; Gruenewald, 2003; Stone & Barlow, 2005; Takano, Higgins, & McLaughlin, 2009). There is a growing concern about humanity's detachment from ecological communities as we have lost touch with our innate "biophilia" (Cajete, 1999, p. 190). Recently, the emergence and increasing popularity of the pedagogies of place- and community-based education have begun to reconnect youth with their local surroundings and offer hope for a more sustainable future for humankind. Prior to this expansion of context-dependent pedagogical methods in schools, conventional education has largely "been a celebration of all that is human to the exclusion of our dependence on nature" (Orr, 1990, p. 49), and to some extent this practice continues today.

Research Questions

Drawing on classroom teachers' experiences working with children and youth in public charter school settings, I set out through this research to record and analyze the best practices of educators and schools that may be contributing to students' ecological literacy. The specific research questions addressed in this thesis are 1) How is ecological literacy fostered in two Alaskan public charter schools? 2) What are teachers' beliefs in these two schools about the way children and youth develop ecological literacy? 3) What are effective teaching methods and what are the challenges in engaging students in ecological literacy?

The population studied included six classroom teachers in two public charter schools in an urban center of Alaska. To protect the confidentiality of the participants, the following pseudonyms are used to represent these two schools: the Northland Charter School and First Light Charter School. These charter schools were selected for the purpose of this research because of the schools' stated missions to empower students through instructional models that are grounded in local knowledge and the cultural contexts for knowing. Both of the schools' missions have immediate relevance to a study of ecological literacy in formal educational contexts. These missions are discussed in greater detail in the methodology section of this report.

Rationale

The primary purpose of this inquiry into ecological literacy was to document teacher perceptions about ecological literacy and the specific methods they use to develop students' ecological literacy. In addition to this aim, there were three other intended outcomes for the research. First, I was able to provide an opportunity for six practicing educators to reflect upon and evaluate the strengths and weaknesses of their teaching practices as they pertain to science and ecology instruction. Second, I sought to further the mission of the local school district to support students in becoming productive members of society. If our public schools are able to foster ecological literacy, then students will have a deeper understanding of the earth's natural systems and will be better positioned to live sustainably on our changing planet. Finally, I intended to promote the multicultural commitment of the district by recognizing and valuing diverse cultural knowledge systems. Ecological literacy incorporates the pedagogies of place- and community-based education, which are rooted in local cultures and knowledge systems. For many regions of Alaska, these knowledge systems are grounded—at least in part—in Alaska Native ways of knowing, which can be acknowledged and valued in educational settings (Kawagley & Barnhardt, 1999).

As the consensus has grown regarding the detachment of human beings from their local environments, so too has the need arisen to understand effective pedagogical methods to foster an ecological consciousness in children and youth and to encourage them to seek more sustainable lifeways than have been the norm in the technomechanistic industrial era (Cajete, 1999; Goleman, Bennett, & Barlow, 2012; Gruenewald, 2003; Kawagley, 2006). If our schools are to continue to be relevant to students and society at large, they must advance the capacity to nurture ecological literacy in students by helping them to develop an understanding of how people and societies relate to one another and to natural systems (Orr, 1992). This is a necessary undertaking if further environmental degradation and crisis are to be avoided. The good news, as Goleman et al. (2012) write, is that a growing number of educators have begun to identify a deeply felt imperative: "to foster learning that genuinely prepares young people for the ecological challenges presented by this entirely unprecedented time in human history" (p. 2). Again, it is the primary aim of this thesis research to capture the efforts of local educators who have taken up this imperative and are putting it into action.

In concluding their study on a place-based education program at Russian Mission School in southwest Alaska, Takano et al. (2009) state that further research must be conducted to explore the relevance of this rural Alaskan model for other schools in other communities. Thus, the research presented in this paper is incredibly timely and an essential area of inquiry. This research project contributes to the growing body of knowledge about fostering ecological literacy in children and youth through place- and community-based education, grounded in unique local contexts and school settings. Furthermore, it highlights a number of successful teaching strategies for developing ecological literacy that are being used by educators in their particular school setting in order to share these methods with the greater educational community.

Another important justification for a research inquiry into ecological literacy and the place-based educational practices that can foster it, is that these are also methodologies that are concerned with decolonizing schooling in order to "undo the damage done by multiple forms of oppression" (Gruenewald, 2010, p. 149). Indigenous epistemologies and educational practices play a critical role in this process of decolonization, as they are "based on a recognition that human interactions with places give rise to and define cultures and community" (Cajete, 1999, p. 193). It is in the shared experiences of local places that teachers and students alike can explore the "culturally and ecologically rich contexts of community life" (Gruenewald, 2010, p. 149), and in which the foundation can be laid to validate and connect with traditions of Indigenous knowledge and experience (Battiste, 2008).

Personally, I have a very strong interest in the pursuit of this research, as a former biology and environmental science teacher in an inner-city high school in Atlanta, Georgia. During this time as a classroom life science teacher, I discovered that my students achieved at the highest level when presented with opportunities for hands-on and relevant learning, such as field trips and service-learning projects. Additionally, teaching in a public school in a severely underprivileged community gave me first-hand experience with the limitations of our current school systems to provide children with a quality and lasting education. I believe much of this is due to a disconnection between schools, the communities they serve, and local environments. Drawing on my experience as a high school science teacher, I was able to offer encouragement, support, and feedback for the research participants during their time of self-reflection.

I have observed that many memorable learning experiences for children take place in authentic situations that are directly relevant to their lives at that given time, and these moments

often seem to occur outside the walls of the classroom and through active participation with the community and local ecology. Sadly, schools and school systems frequently view such instruction as taking time away from more 'urgent' instruction carried out exclusively indoors and focused on high-stakes testing in mathematics and reading. I believe that the pedagogies of place- and community-based education, especially as they contribute to ecological literacy in youth, have much to offer a current educational model that is often devoid of context and which defaults to measuring student achievement through the narrow lens of standardized testing.

Theoretical Framework

This study is grounded in two contemporary research theories: critical theory and complex systems thinking. Critical theory developed out of the work of numerous researchers, including Habermas and Freire in the 1970s. More recently, Gruenewald (2003) has called upon critical theory in his approach to place-based education, which he labels the "critical pedagogy of place." He writes: "Critical pedagogies are needed to challenge the assumptions, practices, and outcomes taken for granted in dominant culture and in conventional education" (Gruenewald, 2003, p. 3). For Gruenewald and others who have contributed to the pedagogies of place- and community-based education, the critical theory paradigm is necessary to produce action research that will ensure that educators strive to discover the best practices to teach young people. I believe this type of research is especially important because it helps to guide the future of education in challenging the status quo as maintained by the dominant Western cultural paradigm.

Numerous authors, including those discussed above, have described the important role that local and Indigenous knowledge and ways of knowing can play in promoting a more contextually relevant educational pedagogy—especially through the use of place-based education. In his critical pedagogy of place, Gruenewald (2003) calls upon local and Indigenous knowledge as a means to help to close the gap in cultural worldviews and, ultimately, to restore an ecological balance. He concludes that educational researchers must provide a "theoretical rationale to connect schools with the social and ecological dimensions of places" (p. 10), and this effort is often made possible through the incorporation of local and Indigenous bodies of knowledge and traditional means of teaching and learning (Cajete, 2005; Goleman et al., 2012; Kawagley, 2006).

Critical theory tends to be polar in nature, pitting the status quo against possible approaches from outside the dominant culture. For this reason I will also draw upon the complex systems theoretical framework, which puts forward an emphasis on holistic approaches to com-

plex issues such as education in our contemporary world. In discussing matters regarding Indigenous education, Barnhardt and Kawagley (2003) assert that systems such as schools are complex and constantly adapting. While teaching in Atlanta Public Schools, I witnessed first-hand the problems that arise when school systems are treated as linear, mechanical structures that can be adjusted simply by manipulating certain variables without consideration of the impacts on other aspects of the system. The reality is that school systems, like many other social institutions, are complex, dynamic, and context-dependent phenomena that must be approached holistically.

Fritjof Capra, a renowned physicist and a founding director of the Center for Ecoliteracy, has written extensively about complex systems thinking. He explains that systems are highly nonlinear—they are networks of relationships—and this is a challenge to the Western scientific tradition, which is based on linear thinking. Capra (2005) goes on to say that systems thinking is "very like the ancient thinking that enabled traditional peoples to sustain themselves for thousands of years" (p. 19). Barnhardt and Kawagley (2003) suggest that complex systems such as schools should be viewed as ecosystems in which all of the parts are intricately interconnected. This framework lends itself quite well to a study of ecological literacy, as both focus on the holistic nature of complex systems and depend upon the wisdom of Indigenous knowledge systems.

Statement of Bias

As I conducted this research on ecological literacy in local schools, I had to recognize my own biases and strive to minimize this bias where appropriate. One strong bias that I hold is that in favor of fostering ecological literacy in public education—a fundamental belief for me that is not universal. Therefore, I have sought to remain open to other viewpoints and ways of knowing that hold a different interpretation of what it means to be ecologically literate in one's geographic location and how educators may or may not go about fostering this literacy in young people.

I was raised in the dominant Eurocentric culture of the United States (Battiste, 2008), but as I have expanded my worldview and explored other ways of knowing I have often experienced a sense of being an "outsider" within my own culture (Brayboy & Deyhle, 2000). I have discovered that my cultural identity aligns very closely with the "Indigenist" worldview described by Shawn Wilson (2008, 2014). This worldview, which Wilson believes should not be exclusive or limited to those individuals who identify as blood descendants of Indigenous cultural heritages, is very similar in nature to those described by a number of critical educators in writing about culturally relevant pedagogies needed for Indigenous or Native education (Barnhardt, 2010; Cajete,

1999, 2005; Kawagley, 2006; Redgrave, 2014). At the core of this Indigenist paradigm are cultural values with which I identify deeply: respect for all (human and nonhuman), interconnectedness, sharing, caring, spirituality, responsibility, unity, honesty, cooperation, recognition for wisdom of elders, and hard work, to name a few (Barnhardt, 2010; Redgrave, 2014). Many of these values emerge from shared experiences in the specific place where a group resides (Cajete, 2005; Gruenewald, 2010; Kawagley, 2006).

Identifying on a personal level with the Indigenist worldview has brought with it a precarious tendency to romanticize ontologies and epistemologies different from that of my upbringing—particularly Indigenous ways of knowing. Therefore, I recognize that caution must be taken in my research investigations not to place any particular cultural group on a pedestal, but rather maintain an openness and understanding that all perspectives of the world are perfectly viable. I believe one of the most effective ways that I have attempted to minimize bias in this thesis research was by grounding my analyses in the context from which the data was obtained. I have also heeded Brayboy and Deyhle's (2000) advice to be aware of the positionality that I maintain in relation to my research participants and also recognize that it is not realistic to separate oneself from the group with which they identify.

Chapter Two: Literature Review

Defining Ecological Literacy

According to Duailibi (2006), the success of our species "will depend on our ecological literacy, that is to say, on our skills to apprehend knowledge from nature, to understand the basic principles of ecology, and to live accordingly" (p. 65). Caduto (1998) refers to ecological literacy as "environmental intelligence," encompassing "all aspects of our awareness and understanding of the earth as well as our ability to maintain a healthy, sustainable relationship with the natural world" (p. 11-12). Without ecological literacy, humans risk causing irreversible damage to the natural systems that sustain life on earth (Gruenewald, 2003; Orr, 1992; Takano et al., 2009).

The concept of ecological literacy draws from a wide array of interrelated disciplines. A number of authors describe ecological literacy—referred to by some as "ecoliteracy"—as one intended outcome of environmental education (Berkowitz, Ford, & Brewer, 2005; Goleman et al., 2012; Orr, 1990, 1992; Stone & Barlow, 2005). For Orr (1992), who was one of the first to elaborate upon the term ecological literacy in the early 1990s, his intention was to describe a state of awareness and understanding which would result directly from environmental or "Earth-centered education" (p. 92). He continues, "Knowing, caring, and practical competence constitute the basis of ecological literacy" (Orr, 1992, p. 92), and the truly ecologically literate person is deeply concerned with "living well in their place" (p. 103). Goleman et al. (2012), as well as the founding directors and members of the Center for Ecoliteracy, would agree that to be ecologically literate is also to live in accordance with the principles of ecology and to maintain a sustainable and healthy relationship with others, human and nonhuman. These authors refer to such a practice as "socially and emotionally engaged ecoliteracy" (Goleman et al., 2012, p. 7).

Others have suggested that the term ecological literacy is self-limiting, as it can easily be taken as a cognitive exercise involving the mere understanding of the key principles of the science of ecology and including no further action component for participation in environmental or sustainability issues (Berkowitz et al., 2005). Alternatively, "environmental citizenship" has been proposed as a term to capture the essence of what Orr (1992) originally intended. Environmental citizenship is defined as "having the motivation, self-confidence, and awareness of one's values, and the practical wisdom and ability to put one's civics and ecological literacy into action" (Berkowitz et al., 2005, p. 228). In this model (see Figure 1), ecological literacy is viewed as one essential component of the overall goal for environmental citizenship.

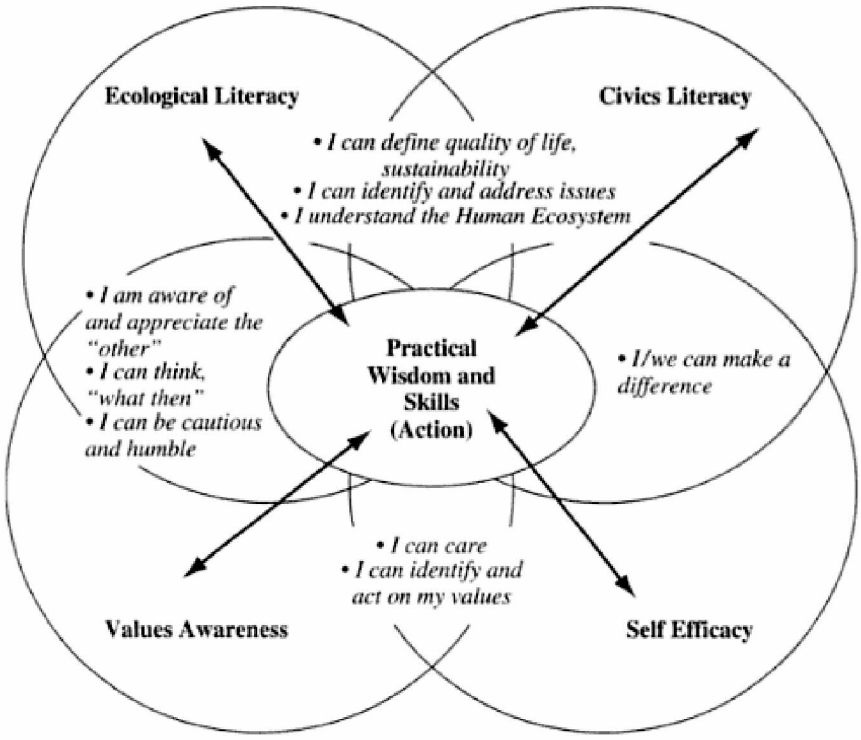

Figure 1. The five overlapping components of environmental citizenship: ecological literacy, civics literacy, values awareness, self-efficacy, and practical wisdom (from Berkowitz et al., 2005, p. 230). Used with permission from Cambridge University Press.

As this thesis research was focused on the study of charter school teachers and their current practices, I chose to utilize the concept of ecological literacy as the point of departure for interviewing participants and to frame the research questions. As Goleman et al. (2012) explain, socially and emotionally engaged ecoliteracy is a necessary prerequisite for youth to feel empowered and capable of taking on ecological challenges of our present era. It is understood that Orr's (1992) original intent in expanding upon the term was to describe the cognitive understanding of ecological principles *as well as* one's ability to live in accordance with those principles, and this definition was shared explicitly with the research participants.

Green, C., Kalvaitis, D., and Worster, A. (submitted for publication) have developed the Environmental Identity Development (EID) model, which seems to capture the essence of ecological literacy as it has been explored through this research. Further, I believe this model can be used as a measure for the development of ecological literacy throughout one's life. These authors put forth the argument that "feelings of assurance and comfort in the natural world" are the foundation of the EID model (Green et al., submitted for publication, p. 17). They go on to explain

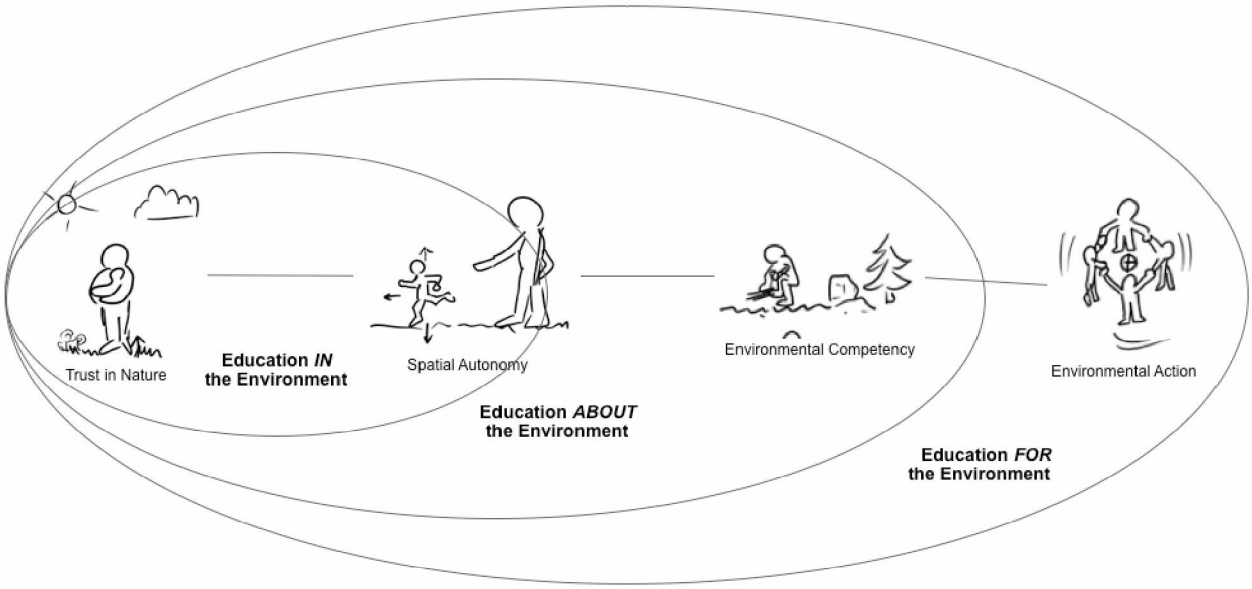

Figure 2. Model of Environmental Identity Development (from Green, C., Kalvaitis, D., & Worster, A., submitted for publication, p.10). Used by permission of authors.

how a healthy environmental identity, rooted in a sense of trust in nature, provides the basis for subsequent spatial autonomy in nature, environmental competency, and ultimately, an ethic of applied environmental care and action for a sustainable future. Figure 2 shows that these four stages of environmental identity development are fostered by education *in*, *about*, and *for* the environment (Lucas, 1979), and they exist in an interdependent system of ever-broadening circles that build from one level to the next. Therefore, the basis for a healthy and complete environmental identity is *trust in nature*, which arises from education in the environment (Green et al., submitted for publication, p. 10). Again, this model seems to me to represent the spirit of ecological literacy as Orr (1992) intended, and it will be used as lens through which to present the findings from the student work samples collected for this research.

It is worth noting that the EID model is reminiscent of Sobel's (1996) developmental levels of nature study, which several teachers made mention of in their interviews as informing their teaching practice. Empathy is the first level of nature study for Sobel (1996), which may share an association with trusting in nature as well as receiving education in the environment. Sobel's (1996) second level is exploration in the local environment, which aligns closely with spatial autonomy and environmental competency resulting from education in and about the environment. Finally comes social action for nature, after empathy and exploration have laid the foundation

(Sobel, 1996). This appears to correlate directly with the EID model, in which environmental action is the final stage, fostered by education for the environment.

Ecological Literacy in Public Education

It is widely agreed upon that American public schools have done a poor job of fostering ecological literacy (Cutter-Mackenzie & Smith, 2003; Goleman et al., 2012; Gruenewald, 2003; Orr, 1992; Jordan, Singer, Vaughan, & Berkowitz, 2009; Leopold, 1970), as it is often overshadowed by an increasing emphasis on standards and testing, primarily in the subjects of mathematics and language arts (Behrendt & Behrendt, 2012; Gruenewald, 2003; Kawagley, 2006). Orr (1992) is quite candid in his condemnation of contemporary schooling: "Against the test of sustainability, our ideas, theories, sciences, humanities, social sciences, pedagogy, and educational institutions have not measured up. Schools, colleges and universities are part of the problem" (p. 83). The few policies that have been created for environmental education and ecological literacy programs in schools have often fallen flat due to poor teacher preparation or knowledge, lack of time in the school day, and inadequate funding and administrative support (Berkowitz et al., 2005; Cutter-Mackenzie & Smith, 2003; Gruenewald, 2003). Knowing this, it is not surprising to discover that many adults who possess a strong level of ecological literacy do not cite their schooling as a significant source of this knowledge, instead attributing it to family role models and experiences of natural areas as youth (Chawla, 1999, 2006; Orr, 1992).

Despite the historic inability of schools to promote ecological literacy, the emergence of pedagogies of place- and community-based education during the past two decades provide a possible means by which to nurture a higher level of ecological literacy in youth. Various environmental education programs also have the potential to cultivate ecological literacy; however, environmental education in general tends to lack a professional training dimension and is frequently marginalized within formal education, taking away from its overall efficacy in school settings (Berkowitz et al., 2005, Cutter-Mackenzie & Smith, 2003). For these reasons, place- and community-based educational practices within formal education would appear to hold a stronger potential for change. The "critical pedagogy of place," as described by Gruenewald (2003), has raised numerous questions about the nature and purpose of education and the dominant culture's approach to training young people (p. 9). The status quo of teaching via rote memorization of decontextualized textbook information has been challenged as educators seek to make learning relevant to students through direct participation in real-world activities (Barnhardt, 2002).

The movement towards place- and community-based education has indeed grown in recent years, as public schools across the country have sought to offer students opportunities for this type of real-world engagement and participation in meaningful socio-cultural issues at the local level. The Edible Schoolyard in Berkeley, California was founded by chef Alice Waters to transform public education through gardening, cooking, and healthy school lunch projects in local schools (Waters, 2005). In inner-city Boston, one public high school has led an effort to improve local air quality and students have learned leadership and negotiation skills for community organizing and development (Senechal, 2010). The STRAW project (Students and Teachers Restoring a Watershed) in central California consists of more than thirty schools, a hundred educators, as well as a plethora of businesses, government agencies and non-profits to restore miles of creek bed in agricultural land (Stone, 2005). These are just a few of the many practical, real-world initiatives in public school settings that provide excellent insight into the development of ecological literacy in children and youth through place- and community-based education.

In Alaska, a decade-long partnership between the Alaska Federation of Natives and the University of Alaska Fairbanks, known as the Alaska Rural Systemic Initiative (AKRSI), led to the development of a curricular framework for the purposes of compiling educational resources around key cultural themes such as seasonal subsistence, tribe and community, and living in place (Barnhardt, 2010; Henry-Stone, 2010). This framework, referred to as the "Spiral Pathway for Integrating Rural Alaska Learning" (SPIRAL; see Figure 3), represents an excellent example of place-based education rooted in a cultural context. All of the compiled resources for the SPIRAL can be accessed via the Alaska Native Knowledge Network Web site: www.ankn.uaf.edu. On a more local level, Takano et al. (2009) examined the place-based education program at the Russian Mission School in rural Alaska and brought to light the significance of the cultural and geographical contexts for teaching and learning. This place- and community-based educational effort is still alive and well today, and the instructional leaders at the school strive to align current state curriculum goals with hands-on, meaningful activities rooted in local subsistence practices (J. Moen, personal communication, May 10, 2014; Takano et al., 2009).

For Orr (1992), the study of place is a fundamental organizing concept in education for ecological literacy, and it must include first-hand experiences in the natural world. It seems that by approaching education in this manner, schools could provide the types of opportunities necessary to produce citizens capable of making more sustainable and ecologically sound decisions

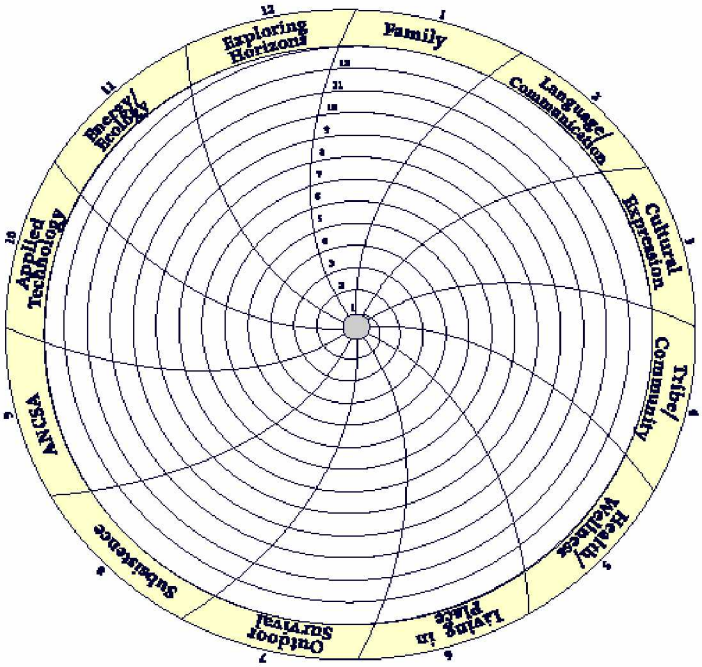

Figure 3. Spiral Pathway for Integrating Rural Alaska Learning, developed as part of the Alaska Rural Systemic Initiative (Barnhardt, 2010; Henry-Stone, 2010). Published with permission from the Alaska Native Knowledge Network (www.ankn.uaf.edu).

based upon a deeply rooted land ethic (Chawla, 2006; Leopold, 1970; Louv, 2005). Indeed, many authors support the assertion that experience in natural areas as youth is a necessary prerequisite for developing ecological literacy and ultimately, environmental citizenship (Berkowitz et al., 2005; Goleman et al., 2012; Jordan et al., 2009; Louv, 2005; Stone & Barlow, 2005; Gruenewald & Smith, 2010). This early exposure to the natural world is one of the hallmarks of place-based education (Gruenewald, 2003; Smith, 2007; Sobel, 2004).

Place- and community-based education is rich with informal learning opportunities, and according to Melber and Brown (2008), this can greatly increase students' confidence in their science ability, especially for students with learning disabilities. Informal, inquiry-based experiences of local ecology can help all students understand science in an authentic and engaging context (Melber & Brown, 2008). Furthermore, when local community resources are an integral part of the school and classrooms extend out into the community, true learning will unfold for

students (Barnhardt, 1998; Gruenewald & Smith, 2010; Martz, 1999; Stone & Barlow, 2005). As Barnhardt (1998) shares:

> Whatever piece of the curriculum you are responsible for, imbed it first in the world with which the students are familiar and work outward from there. Adapt the content to the local scene and then help the students connect it to the region, the nation, and the world. (What should you teach? section, para. 3)

As a transition in public schooling occurs in which the context for teaching and learning is always taken into account, the likelihood for greater student engagement and success will increase.

Insights from Local and Indigenous Knowledge

Outside of formal educational contexts, ecological knowledge and more simply, "science," has been maintained for millennia through observation of the natural world coupled with direct experimentation in natural settings (Kawagley, Norris-Tull, & Norris-Tull, 1998; Leopold, 1970; Peat, 2002; Stephens, 2000). For many Indigenous peoples worldwide, this knowledge was acquired by learning to live off the land through subsistence practices and direct observation of elders (Cajete, 2005 Kawagley, 2006; Peat, 2002; Takano et al., 2009). Barnhardt and Kawagley (2005) write: "The depth of Indigenous knowledge rooted in the long inhabitation of a particular place offers lessons that can benefit everyone, from educator to scientist, as we search for a more satisfying and sustainable way to live on this planet" (p. 9). These authors have begun to shed light on the possibility that exploring Indigenous knowledge and traditional approaches to teaching and learning could help to address the lack of ecological literacy in the general public.

According to Eicken (2010), "Intimate and long-standing familiarity with a specific place, often based on the use of resources at that location, is generally referred to as local knowledge" (p. 360). Indigenous knowledge (IK) includes local knowledge as well as other beliefs and values that are incorporated into a worldview shared by a larger community that encompasses the human and spiritual realms (Eicken, 2010). Local and Indigenous knowledge are both relevant in this study of ecological literacy and place- and community-based education. A combined abbreviation, LIK, will be used henceforth to refer to these collective bodies of knowledge.

Recognition of the significance of LIK is growing, especially in the areas of science and education. Berkes (2009), a leading expert in the field of traditional ecological knowledge, writes that it is critical that "our education system provide sensitivity to different ways of knowing for the coming generations of both scientists and non-scientists" (p. 154). He goes on to say that In-

digenous knowledge and ways of knowing have an inherent quality of building holistic pictures of a culture's environment and surroundings. In a similar vein, Barnhardt and Kawagley (2005) explain that documenting and critiquing locally situated cultural knowledge will help to "open opportunities to better understand learning in all its manifestations, thereby informing educational practices for the benefit of all" (p. 20). The authors summarize the decade-long project of the Alaska Rural Systemic Initiative to engage local communities in rural Alaska in a variety of education initiatives to incorporate local and traditional knowledge into school curricula and programming. These various efforts have been described in terms of place- and community-based education, and they have typically been met with great success and celebration. Among the many excellent examples of place- and community-based education generated by this work are the Alaska Standards for Culturally Responsive Schools, the SPIRAL curriculum, and Stephens' (2000) *Handbook for Culturally Responsive Science Curriculum*.

Pedagogies of place- and community-based education that foster ecological literacy should lead to an educational paradigm that is immersed in the local community and culture and has profound meaning to its students (Gruenewald & Smith, 2010; Kawagley & Barnhardt, 1999; Smith, 2002). Schools should prepare students with useful knowledge to make a living and to lead a meaningful life. In order to do so, education ought to include teaching and learning about the students' culture and it should also help them to develop a "sense of place" (Gruenewald, 2003; Kawagley & Barnhardt, 1999; Sobel, 2004). Wisdom from local and Indigenous knowledge systems could provide a catalyst to awaken a sense of admiration and respect for nature in youth and to embolden them to "re-design human presence in this world" (Duailibi, 2006, p. 66). More importantly, these enduring knowledge systems offer deep insights into humankind's ability to exist on this planet through sharing in the vast interconnectedness of all beings, living and non-living (Cajete, 1999, 2005; Gruenewald, 2010; Kawagley, 2006; Peat, 2002).

LeFay (2006) puts forth the argument that mainstream Western education is a leading cause of the ecological crisis facing our society, explaining that this system for education has strong historical ties to industrial civilization (p. 35). Both of these structures arose from a linear, mechanistic worldview that has generated an approach to education in which knowledge is compartmentalized into school subjects frequently lacking context (Barnhardt, 2002). This worldview and the approach to education that it has produced exists in stark opposition to the spiritual, cyclical worldview of many Indigenous cultures (Berkes, 2009; Kawagley, 2006; Mer-

culieff, 1990; Peat, 2002). LeFay (2006) and others call for an educational transition away from the mechanized, corporate-driven Western worldview towards a holistic, ecological perspective characteristic of Indigenous cultural traditions (Battiste, 2008; Berkowitz et al., 2005; Cajete, 2005; Callenbach, 2005; Gruenewald, 2003, 2010; Kawagley, 2006; Orr, 1992). In his critical pedagogy of place, Gruenewald (2003) calls upon LIK as an educational complement to help to close the gap in cultural worldviews and, ultimately, to restore an ecological balance.

Kawagley (2006) explains that Indigenous peoples "have traditionally acquired their knowledge of the world around them through direct experience in the natural environment" (p. 75), and Cajete (1999) believes this strengthens humankind's biophilic tendencies. On the other hand, the Eurocentric, Western model of education typically presents knowledge out of context and even discriminates against traditions of LIK through institutional norms (Barnhardt, 2002; Battiste, 2008; Greenwood, 2013). This is possibly the most important distinction that must be recognized between these worldviews—that for most Indigenous people, all knowledge comes to be understood in relation to the whole and cannot be compartmentalized (Battiste, 2008; Cajete, 2005; Kawagley, 2006; Redgrave, 2014). Science, and more specifically ecology, is embedded into the holistic worldviews of Indigenous knowledge systems that emphasize the practical application of skills and recognize the intricate web of interconnectedness in which harmony and balance must be maintained (Cajete, 1999, 2005; Barnhardt & Kawagley, 2005; Stephens, 2000). In the Western worldview, science is limited to evidence within the physical world, which is entirely decipherable to the rational human mind (Kawagley and Barnhardt, 1999; Stephens, 2000).

Exploring Common Ground between Ecological Literacy and LIK

It is possible that the notion of ecological literacy, especially when fostered through place- and community-based education, may offer one meeting point at which to bring together the vastly different worldviews and perspectives representative of Indigenous and Western epistemologies (Barnhardt & Kawagley, 2005; Gruenewald, 2003, 2010; Orr, 1992; Stephens, 2000). The development of ecological literacy in any educational context—formal, informal, institutional, or outside of institutions—could provide a foundation upon which to construct a collaborative discourse and to promote cross-cultural communication. Similarly, place- and community-based educational approaches establish common ground for this work to take place, rooted in local communities and distinct places. In order to meet these goals, education must be culturally responsive and meet the expressed needs and desires of the communities being served (Ongtooguk, 2010).

Education for ecological literacy should "change how we live, not just how we talk" (Orr, 1990, p. 50), and it should incorporate an interdisciplinary, critical pedagogy to encourage students to analyze all of the social, cultural, and ecological aspects of human relationships with one another and with the natural environment (Gruenewald, 2003). The literature on place- and community-based education highlights the fact that ecological literacy is often acquired in context-rich experiences with the natural world, which is a center point of Indigenous ways of knowing and being (Cajete, 2005; Kawagley, 2006; Stephens, 2000). As Barnhardt and Kawagley (2005), Berkes (2009) and many others have shared, Indigenous knowledge and ways of knowing offer great insights that can inform educational approaches to address the lack of ecological literacy in the general public.

The Alaska Rural Systemic Initiative (AKRSI) developed a wide array of programs to document Indigenous knowledge in order to make it more accessible to schools in Alaskan communities while simultaneously loosening up the hierarchical structure of Western knowledge (Barnhardt & Kawagley, 2005). A guiding principle of the AKRSI is that Indigenous and Western knowledge systems can come together in mutually productive ways "that increase both the depth and breadth of learning opportunities for all students" (Barnhardt, 2010, p. 122). A metaphor of converging streams was developed by the AKRSI to describe the process of Western and Indigenous (Native) knowledge systems coming together in order to establish common ground from which to build collaborative programs and opportunities for public schools.

Many Indigenous scholars believe the time is ripe for a transition away from the Eurocentric approach to education in favor of an approach as described by the AKRSI (Battiste, 2008; Cajete, 2005; Kawagley, 2006; Redgrave, 2014). The transition must take place within institutions of higher education as well as the public school systems that reflect the norms of these institutions and serve to perpetuate longstanding, destructive cycles of colonization (Gruenewald, 2010). Barnhardt and Kawagley (2003) believe that a paradigm shift is indeed under way, in which Indigenous knowledge and ways of knowing are being validated as complex knowledge systems with an adaptive integrity of their own. Such a shift needs to occur within the classrooms and hallways of schools. Battiste (2008) writes:

> To effect reform, educators need to make a conscious decision to nurture Indigenous knowledge, its dignity, identity, and integrity by making a direct change in school philosophy, policy, pedagogy, and practice. They need to develop missions and purposes that

> carve out time and space to affirm and connect with the wisdom and traditions of Indigenous knowledge. They need to teach holistic and humanistic connections to local and collective relationships. (p. 89-90)

Common ground between ecological literacy and LIK is found not only in common experiences of local places, but also in efforts for decolonization of public schooling. I believe that Indigenous epistemologies should be at the center of *all* practices of place- and community-based education, for it may be that this is the only way educators can understand "the enduring legacy of colonization and the possibility for diverse cultural ways of being" (Gruenewald, 2010, p. 151).

In *My Own Trail*, Athabascan elder Howard Luke (1998) writes: "The reason I want to spend all this time, teaching the younger generation about the culture and survival skills is I think their generation is going to have to go back to this stuff the way we are going" (p. 90). The increasing concern over humankind's detachment from local ecological communities has increased efforts to uncover ways in which people can restore harmony and balance in the world, and the wisdom of LIK has much to offer this conversation. Many individuals from inside and outside Indigenous communities believe that we must cultivate educational methods that enable youth to develop an ability to live sustainably on earth through a life that is fulfilling and meaningful (Cajete, 1999; Duailibi, 2006; Gruenewald, 2003; Kawagley, 2006; Orr, 1992). There are a number of programs and educational resources already in place that draw upon LIK to develop culturally appropriate practices for teaching and learning, including the examples discussed above. However, there remains work to be done to develop *more* programs for education that is grounded in LIK and the practices of local communities. As the examples from Indigenous educational approaches have pointed out, modern schools could benefit greatly from making education relevant to youth.

Though the methodologies of ecological literacy and place- and community-based education are Western in origin, when viewed through the lenses of LIK they can foster mutual understanding across worldviews, as well as respect, awareness, and cross-cultural communication—finding common ground in experiences of local places. All education can help children and youth discover boundaries, learn their cultural values, acquire practical skills and knowledge for survival and subsistence, build relationships, and develop an empathetic imagination for diverse ways of being and knowing. As a society, we may need to be willing to allow for education and schooling to be defined more loosely, thus providing the freedom for communities to determine how best to meet their own educational needs for their students.

As explained in the introduction, the primary purpose of this research was to document the best practices of teachers who may be contributing to students' ecological literacy. The three research questions examined were 1) How is ecological literacy fostered in two Alaskan public charter schools? 2) What are teachers' beliefs in these two schools about the way children and youth develop ecological literacy? 3) What are effective teaching methods and what are the challenges in engaging students in ecological literacy? The next chapter will address the methodological approach used to investigate these questions for the research inquiry.

Chapter Three: Methodology

A Case Study Approach

Education research is typically divided into three broad categories: qualitative research, quantitative research, or mixed methods research. The use of the particular methods in the research investigation is generally based upon the nature of the research questions (Creswell, 2012). For this research inquiry into ecological literacy in two public charter schools, a qualitative case study approach was utilized, featuring semi-structured interviews with three teachers in each school and a review of relevant documents including student work samples and charter materials. I believe that the group of three teachers from each of the two schools studied represents one specific case for this research investigation, as the context of each school is quite unique (O'Leary, 2014; Stake, 1995).

Initially, the three research questions considered for examination were 1) How is ecological literacy fostered in two Alaskan public charter schools? 2) What are the perceptions of teachers in these schools about how youth develop this type of literacy? 3) What specific methods are these teachers employing to develop ecological literacy in their students? Through the course of interviewing the teachers and beginning the data analysis, however, it became evident that the research questions needed minor revisions in order to elicit the greatest meaning from this study. The research questions were thus modified: 1) How is ecological literacy fostered in two Alaskan public charter schools? 2) What are teachers' beliefs in these two schools about the way children and youth develop ecological literacy? 3) What are effective teaching methods and what are the challenges in engaging students in ecological literacy?

Creswell (2007, 2012) explains that qualitative methods are appropriate for research questions in which many variables are unknown, as was the situation with this study. O'Leary (2014) writes that the qualitative research tradition emphasizes "the value of depth over quantity and works at delving into social complexities in order to truly explore and understand the interactions, processes, lived experiences, and belief systems that are a part of individuals, institutions, cultural groups, and even the everyday" (p. 130). Building on this tradition, the qualitative case study approach enabled me to explore the research questions through the lived experiences and belief systems of individuals—in this case, classroom teachers in two public charter schools (Stake, 1995). This approach also allowed me to focus on the quality of the interviews, exploring details and nuances specific to the teachers' experiences with ecological

literacy in their personal lives, and subsequently, in their work as educators (Riordan & Klein, 2010). Stake (1995) describes how the researcher engages with participants in a case study: "We enter the scene with a sincere interest in learning how they function in their ordinary pursuits and milieus and with a willingness to put aside many presumptions while we learn" (p. 1).

Another reason why a case study approach was employed for this project was due to the intricate connection that ecological literacy shares with local and Indigenous knowledge systems and ways of knowing, despite being a decidedly Western concept. Culture plays an integral role in the study of ecological literacy because an individual's cultural background (whether teacher or student) is significant in the development of their relationship with the natural world. For example, traditional ways of life tend to include the development of ecological awareness through the activities of a subsistence lifestyle steeped in animistic myth (Cajete, 2005; Kawagley, 2006; Merculieff, 1990). As explained in the literature review, knowledge is not compartmentalized in these traditional worldviews and it does not make sense outside of the context in which it is experienced. Taking all of this into consideration, a qualitative case study utilizing semi-structured interviews seemed most fitting for an inquiry into ecological literacy. As a case study researcher, I sought to gain a deeper understanding of the people and topic under investigation, which required listening closely to the participants' stories, rooted in their own unique backgrounds and contexts (O'Leary, 2014; Stake, 1995; Wilson, 2014). The complex nature of ecological literacy required a measured approach with regard to the research methodology; thus, I believe an in-depth qualitative case study guided by the complex systems theoretical framework was suitable.

School Settings and Research Participants

The participants studied for the purposes of this research on ecological literacy were six classroom teachers in two public charter schools in an urban center in Alaska. As stated previously, pseudonyms are used to represent these two schools: the Northland Charter School and First Light Charter School. These charter schools were selected for the purpose of this research because of the schools' stated missions, which have immediate relevance to a study of ecological literacy and draw upon first-hand experiences with local and Indigenous knowledge. Northland Charter School serves students in kindergarten through 8th grade, while First Light Charter School serves 7th through 12th grade students. The research participants are responsible for students across this entire age range, kindergarten through 12th grade, and their differences in experience across this range are considered and discussed in the findings of this study.

Charter school selection. The publicly stated mission of the Northland Charter School is to support students in developing a strong sense of place, in order that they might become active citizens of their community. Students are provided with meaningful explorations and activities outside the classroom in which they are encouraged to think creatively, engage in critical thinking, and develop a sense of social and ecological responsibility. Northland Charter School was founded on principles of place- and community-based education, and as such, I believe that there are great insights that can be gained by exploring teachers' approaches to developing ecological literacy in children and youth at this school.

At First Light Charter School, the mission is to empower students through instructional models that are grounded in tradition and culture and combine Western and Native ways of knowing. The curricular framework upon which the charter for First Light was established was developed by a group of Alaska Native educators and regional leaders, and it includes such themes as energy and ecology, living in place, outdoor survival, and community and tribe. Although the majority of students at the school identify as having at least some Alaska Native cultural heritage, the school openly welcomes all students in the district who choose to attend. As with the Northland Charter School, I believe that the educators at First Light have important perspectives and understandings about ecological literacy in youth, especially as it may be nurtured through diverse cultural perspectives and traditions of LIK.

Northland and First Light Charter Schools were not chosen as the sites for this research *because* they are charter schools. However, it seems that the curricular freedom these schools have been granted through the public charter process has enabled the founders of the schools to adopt missions beyond the scope of other schools in the same district. In addition to focusing on the ecological contexts for teaching and learning, these schools also have an opportunity to examine the unique cultural contexts in which they are situated. The conditions of the charters for these two schools also means a much smaller overall size than other schools in the district. I believe this positively impacts the ability of teachers in these schools to foster ecological literacy.

Research participants. Table 1 provides the list of teacher participants, the school and current grade level in which they teach, the number of years they have been teaching, and the degrees that each of them holds. Pseudonyms are used to represent the teachers and certain details of their specific contexts have been excluded so as to protect their confidentiality.

Table 1. Teacher Participant Profiles

Teacher	School	Current Grade Level	Years Teaching	Degree(s)
Denise	NCS	Primary	13 + 10 EE	B.A. Modern Dance M.Ed. Creative Arts in Learning; PB cert.
Eric	NCS	Elementary	17	B.S. Environmental Studies & Economics M.Ed. Curriculum & Instruction; PB cert.
Lynn	NCS	Middle school	13	B.A. English Literature M.A. Teaching 7-12 ELA; PB cert.
Lucy	FLCS	Middle school	13	B.A. Political Science M.A. Cross-cultural Studies; PB cert.
Julie	FLCS	High school	7	B.A. Liberal Studies & B.S. Biology PB cert.
Carol	FLCS	High school	20	B.S. Physical Education M.A. SpEd; PB cert. (Administration)

Key
NCS = Northland Charter School
FLCS = First Light Charter School
PB = Post-baccalaureate certification
EE = Environmental education
ELA = English Language Arts

Teacher #1: Denise. Denise is a primary school teacher at Northland Charter School, where she has taught since it first opened in 2008. She has 13 years of total classroom teaching experience, all in Alaska, having worked previously in several other elementary schools in the same district. Denise has taught 1st through 3rd grades, as well as gifted education; she prefers working with the youngest primary school students. She grew up in Massachusetts, and studied modern dance as an undergraduate. She says that she has always had a passion for science, and therefore chose to complete a master's degree in education on integrating science and the arts. Prior to moving to Alaska, where she completed a post-baccalaureate teacher certification program in elementary education, Denise worked for ten years as an environmental educator for nature centers and Audubon programs throughout the New England region.

Teacher #2: Eric. Eric was born in Maine but moved to Alaska at age 12, and he considers it home. Like Denise, Eric has been teaching at the Northland Charter School since the school opened. In fact, he was one of the founders of the school, helping to write the curriculum and de-

velop the charter along with three other individuals—all but one of whom continue to work at the school. He believes strongly in Northland's mission to support students in developing a strong sense of place, as well as social and ecological responsibility, through pedagogies of place- and community-based education. Eric studied environmental science and economics as an undergraduate, and completed a master's of education in curriculum and instruction while writing the charter for Northland. He obtained his teacher certification through a post-baccalaureate program.

Eric is an elementary teacher at Northland, having always preferred working with this age group. With the exception of kindergarten, the elementary school at Northland Charter works on a two-year 'looping' model in which students have the same teacher all-day long for two years. Teachers thus move with their students from one grade level to the next over the course of those two years, before the students move on to the next two-year block with a new teacher. The goal for this model is for teachers and students to form strong bonds in order to improve educational focus and intensity. Eric has taught for 17 years in all as a certified classroom teacher. Prior to the opening of Northland Charter School, he taught for 11 years at another elementary school in the same district, and he completed a year of student teaching in a rural Alaskan village.

Teacher #3: Lynn. Lynn is a relatively new arrival to Northland Charter School, now in her second year of teaching middle school language arts and social studies there. Though new to the school, she has always been an enthusiastic advocate for place- and community-based education. She taught high school English and Alaska studies for six years in the same district Northland is a part of, and prior to that she taught for six years in a rural Alaskan village. While teaching in rural Alaska, Lynn was responsible for teaching language arts, social studies, PE, health and all elective curriculum. She also worked with local community members to help develop culturally relevant educational opportunities and to include elders in activities and curriculum programs at the school and off-site. In all, Lynn has been teaching for 13 years, having earned a bachelor's degree in English literature and a master's degree and certification in teaching for 7-12th grade English language arts and social studies.

At Northland Charter School, the middle school students rotate between two teachers: Lynn, who teaches language arts and social studies, and her counterpart, who teaches science and math. This enables the school to have highly qualified content area teaches who focus on their specific curriculum areas. There are approximately 50 students in the middle school, many of whom attended Northland for the bulk of their elementary schooling as well. By using creative

scheduling and working together, the middle school teachers are able to provide large blocks of uninterrupted time. This allows for great freedom for Lynn to conduct large-scale projects as well as outdoor or off-site investigations, rather than having every class each day for a short time period like many other middle school teachers in the district.

Teacher #4: Lucy. A middle school teacher at First Light Charter School, Lucy has been at the school since the very beginning nearly ten years ago. Like Eric at Northland, Lucy was instrumental in drafting the original charter for First Light. She worked as part of a team of Alaska Native educators and regional leaders to establish the foundation for the school, which is rooted in tradition and culture and seeks to blend Western and Native ways of knowing. Lucy holds a bachelor's degree in political science and a master's in cross-cultural studies. She became certified to teach all middle school subjects through a post-baccalaureate program.

Like the majority of her students, Lucy identifies as Alaska Native, with 50 percent each of Native and Scandinavian ancestry. She feels strongly about the need to provide an education for her students that includes elements of an Indigenous curriculum and demonstrates the value of Native ways of knowing. Before coming to First Light, Lucy spent three years teaching in a mainstream elementary school in the same district. While working at the other school, she frequently witnessed Alaska Native students being stigmatized in such as way as to feel uncomfortable and even ashamed of their cultural heritage. She is determined to reverse this educational script for her students' sake.

Teacher #5: Julie. Julie is the high school science teacher at First Light Charter School. She is in her second year at the school, having taught previously for five years in California. She is responsible for teaching several science courses each year, including biology, earth science, field ecology, health and other electives depending upon enrollment numbers and student needs. Her courses are filled with students in 9th through 12th grades, some of who have been at First Light Charter School since 7th grade. Julie holds bachelor's degrees in liberal studies and biological sciences and completed a post-baccalaureate program to become certified to teach high school biology and earth science. She came to First Light when a position opened up shortly after moving to the area. Prior to teaching, Julie worked as a field biologist on seasonal research projects throughout Alaska.

Teacher #6: Carol. In a sense, Carol is the least traditional of all of the research participants in that she is not currently working as a classroom teacher. However, she has 20 years of

experience in public education, including teaching physical and special education, as well as her current role as the early college coordinator and general support staff for First Light Charter School. She received her undergraduate degree in physical education, and master's in special education with several professional endorsements, including administration. Carol lived off and on in Alaska and worked for 13 years in school districts outside of the state before moving here permanently. She is entering her seventh year at First Light.

In her role as early college coordinator, Carol assists nearly 100 high school students in completing entry-level college coursework (for credit) while they simultaneously fulfill their high school requirements for graduation. In addition, she facilitates the development and execution of a wide variety of programs and initiatives at the school in conjunction with the University of Alaska and an array of community organizations. Carol's passion for dreaming big and supporting her students is intense, as she strives to provide meaningful learning opportunities for all of them. As an example, while at First Light she has worked to grow the school garden program as well as their chapter of Future Farmers of America in order to encourage the students to make real-world connections between what they learn in science with what they eat every day.

Ethical considerations. Before recruitment could begin for research participants, formal approval was obtained from both the local school district and the University of Alaska Fairbanks' Institutional Review Board (IRB). The required documentation is on file under package number 595440-1. See Appendix A for a copy of the IRB Approval Letter. After receiving this approval, principals at both of these schools were contacted in order to initiate communication and on-site authorization for this research (Appendix B). Both of the principals were enthusiastic about the research topic, and I imagine that their eagerness was felt by the potential participants. I elected to allow the principals to determine the best means for recruiting teachers, as I did not want anyone to feel pressured into participating by my direct request. Both principals asked for volunteers, and three teachers at each school offered to participate: five teachers representing kindergarten through 12th grade classrooms, and one teacher who currently serves in an early college coordinator and support role for 9th-12th grade students.

During the interviews, each participant was provided with an informed consent document to sign in acknowledgement of the methods used for this research (Appendix C). Following the recommendation of the school district, no students were studied directly for the purpose of this research, and all data collection with the teachers occurred outside of the students' school day.

Data Collection Methods

Data collection for qualitative case study research typically includes such methods as interviewing, observations, fieldnotes, and document review (Bogdan & Biklen, 2007; Creswell, 2007; Stake, 1995). For the purposes of this qualitative research on ecological literacy in two public charter schools, data was collected through semi-structured interviews, fieldnotes taken during each interview, and a review of documents relevant to the research questions, including charter documents and samples of student work.

Semi-structured interviews. According to Bogdan and Biklen (2007), in qualitative research "the interview is used to gather descriptive data in the subjects' own words so that the researcher can develop insights on how subjects interpret some piece of the world" (p. 103). Qualitative interviewing can be an interpersonal experience, a "conversation between two partners about a theme of mutual interest" (Kvale & Brinkmann, 2009, p. 123), in which knowledge is co-created as the interviewer and interviewee explore their points of view together. Semi-structured interviews are able to provide great depth to qualitative case study research:

> You do not just want subjects to tell their story but instead are encouraging them to share their own ideas and observations. When you approach interviewing this way, you are likely not only to get good descriptive materials but also to generate more abstract ideas about how to think about your topic. (Bogdan & Biklen, 2007, p. 107)

For all of these reasons, I chose to conduct interviews with six public charter school teachers in order to examine the topic of ecological literacy as well as to build new relationships. I believe this to be a critical step in exploring meaningful issues of personal and cultural significance. Wilson (2008, 2014) describes how relationships form the foundation of knowledge, and thus hold an important position in research inquiries, particularly if they have to do with local and Indigenous knowledge traditions. I agree with Wilson (2008, 2014), which supports my decision to conduct interviews so as to capture the essence of ecological literacy as it is understood and fostered by these public charter school educators.

One on one semi-structured interviews were carried out during September and October 2014 with the six teachers at Northland and First Light Charter Schools. These interviews served as the dominant strategy for data collection in this research investigation. As a source of "primary data," the interviews provided current information, targeted towards the specific issue of fostering ecological literacy in public charter schools (O'Leary, 2014, p. 201). Semi-structured

interviews use a flexible structure that starts with a defined interview protocol but allows for a "shift in order to follow the natural flow of the conversation" that enabled me to come away with all of the intended data as well as "interesting and unexpected data" that emerged throughout the interview process (O'Leary, 2014, p. 218).

The semi-structured interviews followed the outlined protocol (Appendix D), which included ten pre-determined questions and potential probes. I designed the interview questions in such a way as to gather as much data as possible relevant to the three initial research questions: 1) How is ecological literacy fostered in two local public charter schools? 2) What are the perceptions of teachers in these schools about how youth develop this type of literacy? 3) What specific methods are these teachers employing to develop ecological literacy in their students? I sought to collect information about the participants' personal backgrounds, including how they developed ecological literacy and the impact of their teacher preparation in this area. I believe that teachers' backgrounds significantly impact their beliefs about ecological literacy as well as the methods that they choose to employ in their teaching practices. In order to encourage more in-depth exploration of each interview question, I also developed a variety of possible probes for use depending on the participants' initial responses (Bogdan & Biklen, 2007).

The small sample size of six teachers was conducive to the qualitative case study approach, emphasizing the individual teacher's perceptions of ecological literacy and the methods that they employ in their professional practice (Kvale & Brinkmann, 2009; Riordan & Klein, 2010; Stake, 1995). The interviews lasted approximately one hour each and all of the questions were addressed in each interview, but the order and depth with which they were discussed differed based upon the flow of the exchange (O'Leary, 2014). This approach allowed the teachers to help guide the conversation and examine their own practices through self-reflection, which was one of the intended aims for this project. As Bogdan & Biklen (2007) write, "Good interviews are those in which the subjects are at ease and talk freely about their points of view" and which "produce rich data filled with words that reveal the respondents' perspectives" (p. 104). I made every effort I could to make the teachers feel comfortable with my presence and the conversation about ecological literacy, assuring them that *they* were the experts and I was there to learn from them (Bogdan & Biklen, 2007, p. 107).

The interviews were conducted individually in each of the six teachers' classrooms at their respective school. In all but one case, the interviews were conducted immediately following

the school day, once all students had been dismissed for the day. For one participant, a preference was indicated for completing the interview before the school day began, and I made certain to meet this teacher's request. In every case, both the teacher and I sat in adjacent seats where the students sit while school is in session, and an informal atmosphere was quickly established between the two of us. Occasionally, a student would appear in the doorway with a question for the teacher, but these brief interruptions rarely disrupted the overall flow of the interview.

As teachers' schedules are very busy, it proved to be quite challenging to arrange convenient times for the interviews to take place. The order in which participants were interviewed was determined solely by their availability. Many of the participants help to lead extracurricular activities at their respective schools, and thus, finding a time after school to meet was often difficult. I made every effort I could to accommodate the teachers' schedules by rearranging my own affairs in order to meet with them at a date and time of their choosing. In several instances, I had follow-up questions and clarifications that I hoped to resolve with a teacher and finding a second time to meet was even more challenging. I found myself needing to make frequent visits to the school immediately following the school day in order to catch a few moments of the teacher's time in between the school day and their extracurricular commitments.

With the permission of each teacher, I audio recorded the interviews to preserve the raw data for review and transcription at a later date, thus allowing me "to focus on the question/answer process at hand" (O'Leary, 2014, p. 227). I used a digital voice recorder to produce high quality sound recordings for accurate transcription. The small size of the device helped to minimize the possibility of distraction caused by its presence in the interview setting. The original .mp3 files from the recorder were easily transferrable to a secure computer storage location via USB drive. The interview transcripts created from these audio files served as the main data for this qualitative case study research (Bogdan & Biklen, 2007).

Fieldnotes. In addition to audio recording each interview, I took written fieldnotes on an expanded template of the interview protocol that included blank space in which to record my general impressions, notable quotes, as well as some initial interpretive ideas. According to Bogdan and Biklen (2007), fieldnotes are "the written account of what the researcher hears, sees, experiences, and thinks in the course of collecting and reflecting on the data in a qualitative study" (pp. 118-119). By taking fieldnotes in conjunction with audio recording the entire interview, I was able to prevent myself from being distracted by the note taking process or concerned

about missing something that the interviewee had said (O'Leary, 2014). For the most part, my fieldnotes were sparse, as I strived to listen intently during each interview and maintain my focus on the responses and insights shared by the teachers.

Immediately after each interview, I would conclude my fieldnotes by writing my thoughts and overall impressions in a "post-interview data dump" (O'Leary, 2014, p. 227). Typically, I recorded these thoughts while sitting in my car before leaving the school site. The post-interview fieldnotes proved quite valuable over the course of the data collection and analysis processes, as they captured ideas, strategies, and reflections, as well as patterns that emerged across the data (Bogdan & Biklen, 2007, p. 118).

Document review. In addition to collecting data through the semi-structured interviews and fieldnotes, the meetings with each teacher also included time for photographing examples of relevant student work and classroom artifacts relating to the research questions (Appendix E). O'Leary (2014) describes data that is obtained from documents such as these as "secondary data," which "exists regardless of a researcher's questioning, prompting and probing" (p. 243). The author goes on to explain that a document review should be treated similar to an interview:

> As with an interview, you will need to determine what it is you want to know, and whether your document can provide you with answers. You then need to 'ask' each question and highlight the passages in the document that provide the answer. (O'Leary, 2014, p. 251).

Stake (1995) agrees that collecting data by studying documents should follow "the same line of thinking as observing or interviewing," and says, "Quite often, documents serve as substitutes for records of activity that the researcher could not observe directly" (p. 68). Indeed this was the case for this research study, as the local school district requested that no research be done directly with students. Thus, the collection of student work samples and photographs of classroom artifacts served as substitutes for observing the instructional activities that led to their creation.

In order to gain a more thorough understanding of the context of the two public charter schools, this research investigation also included a review of publicly available charter school documents. These documents served primarily as a source of the schools' mission statements and the structural frameworks upon which they were founded. The extent to which these missions and frameworks have evolved over time was explored during the course of the semi-structured interviews with the teachers at each school.

Data Analysis

Data analysis in qualitative research does not follow the same guidelines as quantitative research. Rubin and Rubin (2005) explain:

> Qualitative analysis is not about mere counting or providing numeric summaries. Instead, the objective is to discover variation, portray shades of meaning, and examine complexity. The goals of the analysis are to reflect the complexity by portraying it in the words of the interviewees and through actual events and to make that complexity understandable to others. (p. 202)

In this qualitative case study research on ecological literacy in two public charter schools, the data analysis reflected the complexity of this issue as I searched for meaning in the data from the semi-structured interviews, fieldnotes, and document review. Data analysis began during the initial stages of collecting data in the field. Through the process of organizing and reflecting on my fieldnotes, I recognized general themes and patterns emerging across the teachers' responses to the interview questions (Rubin & Rubin, 2005).

Transcription. After the interviews were all completed, I transcribed each audio recording verbatim in order to prepare them for qualitative analysis. Though many have suggested that perfect verbatim transcripts are not always necessary in qualitative case study research (Bogdan & Biklen, 2007; Kvale & Brinkmann, 2009; Paulus, Lester, & Dempster, 2014; Rubin & Rubin, 2005), I elected to create accurate transcripts to minimize my distance from the original data (Paulus et al., 2014). To make the manual transcription process more efficient, I trialed two free software programs: the demonstration version of Transana, a Computer Assisted Qualitative Data Analysis Software (CAQDAS) package, and Transcribe, an Internet-based transcription program. Both programs allowed me to use keyboard shortcuts to stop, start, and rewind the audio recording in the same window while transcribing the text, therefore maximizing typing efficiency and speed. Throughout the transcription process, I continued to hear more themes appear, and thus codes for later analysis were also emerging (Rubin & Rubin, 2005). Though it was a tedious process, I am grateful that I took the time to do the transcription myself in order to "remain close to the data" from the original interviews (Paulus et al., 2014, p. 104).

As I completed each transcription, I created a memo file for each transcript to highlight memorable quotes, record my overall impressions, and revise the summary from my original fieldnotes (Rubin & Rubin, 2005). These memo files were helpful during the latter stages of

analysis, as they allowed me to capture the essence of each interview and distill meaning from the data relevant to the research questions. Additionally, as each transcript was completed I shared it with the teacher participant in order to member check their contribution to this research. According to Stake (1995), member checking in qualitative case study research is the process in which participants are asked to review rough drafts of writing" for accuracy and palatability" (p. 115). All of the participants in this research study were offered the opportunity to add or delete anything they shared in the interview. Very few changes were suggested by the teachers. I believe this served to validate the accuracy of their responses to the interview questions as well as enhance the opportunity for self-reflection of their teaching practices.

There were occasions when I would have liked to clarify certain discussion points with a particular teacher, but scheduling additional times to meet was, as mentioned, incredibly challenging. My observation of teachers in general is that they seem to always be busy and overwhelmed or stretched too thin—even excellent veteran teachers. This was certainly true for me, as a young, novice teacher in Atlanta. Nonetheless, as I continued through the qualitative data analysis phase, I included the participants in this stage as well, sharing with them the emerging themes and subsequent explorations. As with the transcripts, I believe this has aided in validating and supporting a thorough investigation (Stake, 1995).

Coding. Initially, I began analyzing the collected data by hand, coding with highlighters on printed copies of the interview transcripts. I included notes in the margins to record my initial impressions, comments, and emerging themes (Rubin & Rubin, 2005). This process helped me to continue to stay close to the raw data, already an abstraction of the audio recordings (Paulus et al., 2014, p. 104). I had several *a priori* (determined beforehand) codes in mind before I began my analysis—mainly those pertaining to the research questions about teacher beliefs of ecological literacy and the specific methods they use to foster it (Saldaña, 2013). These "Provisional Codes" were developed from the "anticipated categories or types of responses" generated by the interview protocol followed in the semi-structured interviews (Saldaña, 2013, p. 144).

The majority of codes for data analysis emerged during the process of "Initial Coding"—a detailed, line-by-line coding process for interview transcripts in which I broke down the qualitative data "into discrete parts, closely examining them, and comparing them for similarities and differences" (Saldaña, 2013, p. 100). Through this Initial Coding, several codes emerged that I had not anticipated, including the challenges relevant to engaging students in ecological literacy

in public charter schools. This phase of the data analysis supported the revision of the original research questions in order to present the research findings more sufficiently and accurately.

After completing the hand coding, I turned to the ATLAS.ti CAQDAS package in order to assist in the qualitative analysis of the interviews and student work samples, searching for overlaps and frequency in the data and exploring meaningful themes. As Bogdan and Biklen (2007) explain, a CAQDAS program like ATLAS.ti can only *assist* because it "helps as an organizing or categorizing tool, and does not do the analysis for the researcher" (p. 187). All of the interview transcripts and photographs of student work samples were loaded into ATLAS.ti in one "hermeneutic unit," the term used by the program to describe a project "container." At this stage, I went through the data and electronically assigned the codes that I had applied by hand during Provisional and Initial Coding.

By using the CAQDAS program, I was able to efficiently store, organize, and manage the data to find information that aligned with the research questions concerning teachers' beliefs about how children and youth develop ecological literacy as well as the effective teaching methods and challenges experienced in engaging students in ecological literacy. Finally, ATLAS.ti facilitated "Focused Coding" to search for the most frequent and significant codes in order to uncover "the most salient categories in the data corpus" (Saldaña, 2013, p. 213). When presenting data in the following chapter, information coded as relevant to the research questions was generated as a report using ATLAS.ti.

I agree with Kvale and Brinkmann (2009) that the small sample size of six teachers allowed me to take more time to properly prepare and analyze the interview transcripts, which were the primary source of data in this research study. The two cases provided the context for analyzing the data relevant to each unique school setting (Stake, 1995). However, I also analyzed the data across all six research participants in order to explore themes relating to ecological literacy that are relevant across all age levels in schooling. Again, the primary aim of this study is to document educators' beliefs about ecological literacy as well as the methods they believe contribute to its development in children and youth. We will now proceed to the presentation of the research findings.

Chapter Four: Findings

This chapter will present findings from the interview data and document review in relation to the three research questions: 1) How is ecological literacy fostered in two Alaskan public charter schools? 2) What are teachers' beliefs in these two schools about the way children and youth develop ecological literacy? 3) What are effective teaching methods and what are the challenges in engaging students in ecological literacy? First, a short discussion of the term "ecological literacy" from the participants' perspectives is offered, followed by explanations of how each teacher developed their own ecological literacy and the common threads identified in this developmental process. Next, the themes that emerged across all six conversations are examined in order to discern meaning from the teachers' beliefs about ecological literacy and the methods they choose to employ to contribute to its development in their students. Then, the two charter schools are presented as unique cases for investigating the research questions concerning ecological literacy. Finally, the document review of relevant samples of student work is shared to explore how ecological literacy is being fostered in these two public charter schools.

Coming to Terms with Ecological Literacy

In order to investigate the question, "How is ecological literacy fostered in two Alaskan public charter schools?" a common understanding of the term "ecological literacy" was needed as a point of departure for the interviews. All of the teachers expressed some hesitation with the term, which would seem to support Berkowitz et al.'s (2005) assertion that "environmental citizenship" may be a more appropriate phrase to capture Orr's (1992) original definition. Before explicitly introducing the term in the interviews (aside from its use on the consent form, which was provided up front), I asked each individual what terms *they* might use to describe "a person's understanding of basic ecological principles and how they can live in accordance with those principles." Denise described it as a "connection to place," while Lynn referred to it as a "sense of place" and even a "sixth sense"—an innate connection to the natural world which she believes we are all born with. Julie, a trained ecologist, viewed ecological literacy largely as it sounds: a broad knowledge and understanding of ecological principles and interconnectedness.

Two of the teachers, Eric and Lucy, had a particularly difficult time with the term ecological literacy. For Eric, the hurdle was the expression itself:

> I have a hard time with what "ecological literacy" is—what the term is. For me, the big thing is, I want kids to appreciate the environment around them. And I want them to see the natural places and grow up loving it.

Later in the interview, I suggested the phrase "ecological consciousness," and Eric enthusiastically received this substitution:

> I like that! I like that expression—that works for me, really well. I really like the "consciousness." It makes more sense to me, because it's that *becoming aware* of what's around you, and I think that's really important. I really like that term.

During my interview with Carol, she suggested this same phrase, ecological consciousness, on her own, believing that it captures the essence of Orr's ecological literacy.

For Lucy, "ecological literacy" is about "living in place," which requires understanding deeply the traditional knowledge and culture of those who have dwelled in that place the longest—for her and her students, this is Alaska Native peoples. Without knowing it, Lucy seemed to be describing one of the primary goals of Orr's (1992) ecological literacy: "the practical art of living well in particular places" (p. 84). The difficulty for her was not so much with the term itself, but rather in knowing that ecological literacy may really only be attainable once a person's basic (and more urgent) needs are satisfied. This was a theme that persisted throughout her interview, and for which further discussion will follow below.

It seems plausible that part of the reason why defining ecological literacy in acceptable terms is so difficult is that it is also a hard concept to measure, especially in a public school setting. As discussed above, ecological literacy often develops over a person's lifetime, and therefore it is hard to quantify and truly understand in the school setting. Despite this difficulty surrounding terminology, all six of the teachers stated a belief that the ultimate goal of ecological literacy—to foster a deeper understanding of key ecological principles and the ability to live according to those principles—is a necessary undertaking for public schooling. In fact, all but one stated that it is *essential*. This seemed to justify my presence with them as well as the overall aims of this thesis research. In general, all of the teachers tended to think about ecological literacy in terms of developing a sense of place and an ever-broadening awareness of one's role with respect to the natural world. Various themes of "environmental citizenship" were heard throughout the interviews, including values, civic literacy and participation, self-efficacy, and practical skills (Berkowitz et al., 2005). It was from this more broad perspective of ecological literacy,

incorporating elements of environmental citizenship, that the interviews moved forward and which form the foundation for the findings presented herein.

Research Participants' Personal Development of Ecological Literacy

This section will present the research findings pertaining to the participants' own development of ecological literacy. These findings are relevant to the research question, "What are teachers' beliefs in two public charter schools about the way children and youth develop ecological literacy?" because their beliefs are directly linked to their own childhood experiences. For this reason, it is important to examine the teachers' childhood experiences in nature as well as their perspectives on how they developed ecological literacy throughout their lives. By discovering common developmental threads, I believe we can establish potential sources of ecological literacy and the motivations of educators—and adults generally—who seek to nurture ecological literacy and environmental citizenship in children and youth.

Schooling. The first important theme to point out, considering that this is a study concerned with fostering ecological literacy in public charter school settings, is that only one out of six teachers believed that their own schooling played a direct role in helping them to develop ecological literacy. During her interview, Julie offered a response to my question, "How do you think youth develop ecological literacy?" without any hesitation:

> For me personally it was at school—elementary school. We had to watch those little "Yakety Yak Take It Back" videos. That's when the "recycle, reduce, reuse" push came into play. And I don't know, my sister and I both listened and bought in. We'd come home and talk to our parents about it, and we came home and started recycling.

It is worth noting that Julie was the youngest of all of the research participants, growing up during a time when environmental issues were returning to the forefront of public thinking after the 20th anniversary of Earth Day in 1990 and the 1992 United Nations Earth Summit in Rio de Janiero (Stone, 2009).

Two other participants stated, without prompting, that school did *not* contribute directly to their sense of ecological literacy. Lynn said: "In school for me it was very institutional, so not so much there." She did also explain, however, that she had an opportunity in 7th grade to go with her entire public school on a cabin camping trip. She shared this with me:

> One of the options for a day trip was to go with one of my teachers while we were there to hike a 'fourteener' [a common expression in Colorado, referring to mountains over

> 14,000 feet tall]. No one had hiking boots; I think he was the only one with a headlamp, but this teacher took us up this mountain [Long's Peak]…we took all day to climb this mountain—that left a lasting impression for me.

Though in general Lynn does not attribute schooling to her development of ecological literacy, she recognizes that this opportunity—made possible through her school—did make a lasting contribution. Carol also had a similar experience, although for her it took place outside of the actual school year. She explained that one of her public school teachers took six or seven youth, from ages 12 to 16, on an outdoor adventure program during his summer break: "backpacking on a *huge* trip in New Mexico in the Truchas National Forest." Just like Lynn, this experience for Carol was highly memorable and she made reference to it when discussing her overall development of ecological literacy. The other three research participants only made passing comments about their schooling as it pertained to developing ecological literacy, and it was clear that it was not perceived as a significant factor for them, and was even a hindrance in some cases.

Family. Another pattern that emerged was that out of the six total participants, four made specific references to the role that their dads played in their development of ecological literacy as young children. For example, Julie said: "Yeah, my dad took us hiking a lot. And I just always enjoyed being outside and just looking at everything. That was from a pretty early age he'd take us out." Eric grew up hunting and fishing with his dad, and he still loves spending a great deal of his time outdoors. In Lynn's response to how she developed ecological literacy, she stated: "I skied a lot with my dad growing up, so I always had that too. But that starts at a young age I think—your age probably plays a factor."

The two participants who didn't specifically mention their fathers did refer to their mothers or family in general as having had an important part in getting them outdoors and instilling in them a strong sense of appreciation for the natural world. For Lucy, ecological literacy developed naturally as she learned the traditional Alaska Native subsistence practices during her childhood. She recognizes that she was heavily steeped in the cultural values of her ancestors, listening to the traditional stories that provided the meaning and context for daily activities:

> I grew up in the village and I was taught a lot by my mother—you know, tanning moose hides and cutting, hunting, fishing, stories, …going up and down the river. So I was steeped in it quite heavily. So that's what colors my perceptions and how I present things.

Carol grew up on a ranch in Texas, and also spent several years as a youth overseas with her family, where she says she was outside every day, swimming, sailing, camping, riding mopeds, and enjoying the company of her international friends. Carol believes that her family and the time she spend enjoying the outdoors contributed most significantly to her ecological literacy.

It is important to know that family played such a critical role in all six of these educators' personal development of ecological literacy. From this, one can begin to understand the challenging context facing public schools, as the influence of family is largely out of their control.

Young age. A third interrelated theme that emerged across the six teachers' responses was that their own ecological literacy began to develop at a young age. Almost everyone made comments about "growing up outside," whether exploring nearby natural areas, hunting and fishing, or adventuring into the mountains with family members and other adults. Denise spent a great deal of her childhood exploring the beach behind her coastal Massachusetts home with her brother, collecting interesting rocks and playing with horseshoe crabs, mostly unsupervised. She attributes much of her passion for ecology to the early emotional connections she formed with the ocean and the beaches. For Lynn, who grew up in urban Colorado, she believes her development of ecological literacy began during her explorations in the mountains at a young age. Julie grew up in southern California, and she believes that the significant impacts that humans have had on the landscape in that region contributed to her awareness of the need to protect the natural world as a youth. Julie was also a member of a local scouting troop and took part in backpacking and other high adventure activities. For her sake, Carol was quick to point out that she spent a large portion of her time outdoors as a child, going on camping trips, attending summer camps, and taking part in various adventure programs.

The themes of spending time outdoors with family and doing so as youth provide evidence consistent with the findings of Chawla (1999, 2006) and Chawla and Cushing (2007). These authors explain that adult environmental advocates attribute their commitment to environmental protection primarily to family role models demonstrating this to them as well as positive experiences in the natural world as youth. While the influence of family may be out of the immediate control of teachers in public schools, it is possible for them to provide children with positive experiences in natural settings as part of the schooling process. The stories shared by Lynn and Carol about adventurous outings led by their schoolteachers are excellent examples.

Long-term development. A final pattern concerning the participants' own development of ecological literacy that deserves attention is that there were many direct references or allusions to the idea that ecological literacy develops over a long period of time. For Julie, for instance, she believes that her undergraduate studies in ecology had a major impact on her overall ecological literacy. Several participants mentioned that they are still growing in this area even today. The implications of this long-term development for the process of schooling are far-reaching, especially considering the fact that ecological literacy is difficult to measure and there are no consistently agreed upon models for the stages of its growth. Thus, it is a challenge for educators to determine the extent to which they contribute to a person's ecological literacy, especially during the younger grades when the seeds are just being sown.

As I stated above, I believe it is critical to understand the backgrounds of each of the research participants, for how a person develops his or her values and awareness of their connections to the natural world shapes how this relationship is presented to others, especially through the powerful vehicle of formal education (Barnhardt & Kawagley, 2005). With these themes in mind regarding how the six participants feel they each developed their own ecological literacy, a brief presentation will be made of their more broad beliefs about ecological literacy and the methods they employ to foster it. This will be followed by a careful examination of the two unique school contexts in which they work as professional educators. Finally, examples of relevant student work will be shared to demonstrate how ecological literacy is being fostered through the work of these six teachers.

Overarching Beliefs about Ecological Literacy Development in Children and Youth

This section presents additional findings pertaining to the research question, "What are teachers' beliefs in two public charter schools about the way children and youth develop ecological literacy?" The data showed a clear link between the teachers' beliefs and their actual teaching practices. Therefore, I believe it is necessary to explore more closely the philosophical orientations which form the foundation for these educators' teaching methods to engage students in ecological literacy and environmental citizenship.

When asked the question, "How do you think youth develop ecological literacy?" some participants responded first with their descriptions of how they believe they developed this type of literacy. Others offered that information with further prompting. Eventually, all of the teachers

Table 2. Participant Quotes about Connection to Place

Participant	Example Interview Quote
Denise	"I think we all need to know where we fit in...have the kids feel that they are connected to a place."
Eric	"Like the science unit I'm teaching right now is learning about plants of the boreal forest so there's a lot of understanding where you are, understanding your forest, the plants in your forest."
Lucy	"...what they're connecting to, where they live, how they use the outside, what their ancestors have done, what their family talks about. All that is the connection and the sense of place."
Julie	"Native cultures, they have their traditional ways of knowing, and culturally, traditionally, they were very respectful of the animals, plants and everything around them."

seemed to approach the question from their vantage point as an educator, working with their specific age group of children.

Connection to place. Across the entire age range, the vast majority of responses had to do with a belief that youth develop ecological literacy by coming to understand the connections that humans share with one another and with non-human communities—a deep awareness of these relationships. Borrowing from the literature and the teachers' own choice of words, this will be referred to as a "connection to place" (Goleman et al., 2012; Gruenewald & Smith, 2010; Orr, 1992; Smith, 2002; Sobel, 2004; Stone & Barlow, 2005). Table 2 offers several participant quotes pertaining to this belief.

Denise believes emotional bonds with the natural world are critical in helping children connect to their places and develop ecological literacy. For Lynn, a lifelong student and teacher of language arts, listening to others' stories is also necessary to help students develop empathy and a connection to place. She works hard to create opportunities for elders and other local community members to share stories and teachings with her students.

Time outdoors. The second most common belief about how children and youth develop ecological literacy had to do with simply spending time outdoors in natural settings. This is in line with one of the primary factors that the participants identified as having contributed to their

own development of ecological literacy, and it is also supported by Chawla (1999, 2006) and Chawla and Cushing (2007).

Eric described his belief that children must be supported in learning to *enjoy* being outdoors and feeling connected to and appreciative of their surroundings. He believes this must happen at a young age, and strives to do his part to instill a sense of appreciation for being outdoors in his students. Similarly, Lynn feels strongly that youth develop ecological literacy at a young age through adventuring outdoors, and she seeks to provide an education for her students that includes an expeditionary component.

Other beliefs. Among the other overarching beliefs shared by the teachers about how ecological literacy is developed were direct involvement with the local community and student investment and enthusiasm. A few other beliefs that were discussed less but which clearly held significance for certain participants were the importance of fostering emotional bonds and empathy, providing opportunities for extended adventure, the impact of hunting, development of ecological literacy at a young age, and the role of family—particularly fathers. It is worthwhile to note that the role of family in fostering ecological literacy was not discussed frequently beyond the participants' own personal development. I suspect this may be due to the fact that it is one of the factors that is out of their immediate locus of control as classroom teachers. Though they recognize the significance of family, they instead choose to focus on those factors with which they can have a more direct impact. The other overarching belief that is worth pointing out at this stage is the idea that hunting may contribute significantly to a youth's development of ecological literacy. All but one of the teachers explicitly shared this observation, unprompted. Lynn said, "Some kids are in tune, they go out camping a lot or moose hunting." Eric made it a point to explain that he sees the youth who hunt with their families as the most in tune with their surroundings for that age group. Referring to one student in particular who is already very observant, he told me: "I'm guessing as he gets older he's going to get an appreciation that there's more going on out there. I know that's how it worked on me as a hunter."

Effective Teaching Methods for Engaging Students in Ecological Literacy

As one might expect, the beliefs of the six teachers regarding how children and youth develop ecological literacy aligned closely with the methods that they employ to foster it in their students. Though this data was all self-reported through the process of semi-structured interviews outside of the school day, all of the teachers shared numerous, specific examples of classroom

projects and activities that were taken at face value as evidence of the methods they use when school is in session. The following findings help to address the first component of the research question, "What are effective teaching methods and what are the challenges in engaging students in ecological literacy?"

Real-world connections. All of the teachers strive to build from the overarching belief that children and youth need a sense of connection to place to become ecologically literate by making real-world connections to their curriculum. They believe these real-world applications can demonstrate humankind's interconnectedness with the rest of the natural world. Indeed, this theme was discussed the most when participants responded to the question, "What specific methods do you employ to develop ecological literacy in your students?" For some of the teachers, especially in the earliest grades, this is primarily about getting their students outside for hands-on learning opportunities and local explorations. They try to allow time for the students' interests to guide the class, and they focus on the practical applications of everything they do.

Denise believes that children must form emotional attachments to the natural world in order to develop a connection to place, and she strives to provide opportunities for her students to form these emotional bonds. Lucy's subsistence background plays a direct role in her classroom teaching, where she helps her students develop a connection to place by sharing the stories and traditions that she learned as a youth with her students. She believes that the traditional ways of life of Alaska Native peoples create a strong form of ecological literacy, resulting from their intimate connection to place. Julie is similarly enthusiastic about the opportunities that teaching at a public charter school with a focus on Native ways of knowing has for helping her students to develop ecological literacy. Additional examples of these methods for real-world connections are presented in the following cases.

Time outdoors. All of the research participants put the belief that children and youth need to spend time outdoors into practice by getting their students outside as much as they see feasible. This was the second most discussed method that the teachers employ for fostering ecological literacy. Carol feels that educators at all levels of schooling must strive to get students outdoors often. Denise, a primary school teacher, believes that children also need *unstructured* time to play outdoors and to imagine, explore, and discover. Denise sees her teaching as a "balancing act," in which she provides her students with this unstructured time outside in addition to

helping them develop the skills and knowledge they will need in formal schooling. Again, additional examples of time spent outdoors as a teaching method will be provided in the cases below.

Other teaching methods. In terms of other practices for fostering ecological literacy that the teachers discussed, no other themes came close to the frequency with which real-world connections and time outdoors were discussed. For the most part, the participants all referred to instruction that directly addressed the basic principles of ecology, but even in these instances the emphasis typically returned to the real-world applications and connections with this material and the fact that this instruction can (and should) frequently take place outdoors. It was quite evident that for these educators, when learning is relevant to youth and they are supported in gaining an appreciation for spending time outside in natural areas, then ecological literacy can develop naturally. Other methods that were mentioned as means with which to nurture ecological literacy included helping students to learn empathy for other creatures, keeping nature journals and creating nature-based artwork, and caring for classroom pets.

The attention is now turned to the contexts within which the six teachers work every day and how they attempt to foster ecological literacy in these settings. The following two cases offer a presentation of findings which serve to address the research questions, "How is ecological literacy fostered in two Alaskan public charter schools?" and "What are effective teaching methods and what are the challenges in engaging students in ecological literacy?"

Case #1: Northland Charter School

Northland Charter School is a K-8th school, whose mission is to support students in developing a strong sense of place. The goal is for students to become contributing members of their community by taking an active role in issues of local importance.

Time outdoors. The charter for Northland is centered on principles of place- and community-based education, and its founders believe that the school does a lot for fostering ecological literacy in its students by presenting them with frequent explorations and activities outside of the classroom. Eric explains:

> This whole school is based on getting kids outside…from taking ski trips around the school to ski trips out in the extended area and out in the community. I mean that's just a tool for exploring our area in the winter. And you know, the kids love it. They want to be out and enjoy the environment.

Northland provides a relatively intimate setting, with approximately 200 total students in a small building. The classroom teachers all know each other well and collaborate on a variety of school-wide activities. Cross-country skis and a colorful array of student work adorn all four main hallways at Northland Charter, and there always seems to be something exciting happening inside and outside of the school. The enthusiasm of all three of the teachers from Northland who I had the pleasure of interviewing was palpable.

Many people in the local community think of Northland as a sort of "outdoor school" because a significant portion of the students' school week is spent outside exploring, skiing, and learning. This claim appears to be supported by the qualitative data. Of all of the themes pertaining to the participants' perspectives and methods to develop ecological literacy, the three teachers from Northland discussed the theme of spending time outdoors the most. This emphasis has also enabled the school to develop a number of structures and routines for managing behavior and logistics while outside with students. The teachers explain that these school-wide systems save a great deal of time and energy, which allows for meaningful learning opportunities to take place when outdoors. Eric says that "to be effective outdoors you have to do it a lot." According to the other teachers, Denise takes her students outside more than anyone else in the school. Nonetheless, she explains that managing students outdoors remains a challenge: "It's hard to listen outside. It is hard and we still work on it. But, it's why it's better when we can be in small groups, because it's hard to tell 22 kids at once about something." Denise has a full-time classroom aide and she also strives to include parents as much as possible to facilitate this smaller group approach when outside. Lynn, who used to teach at a large high school in the district, agrees that having too many students to manage when outdoors can make meaningful instruction nearly impossible. Regarding her efforts while teaching at the high school, she stated: "You just couldn't leave with all the kids. Number one you had too many kids—30 in each class, you had 6 classes, you just couldn't do that."

Looping and content specialties. As described previously, the elementary grades at Northland Charter School utilize a two-year looping model that encourages collaboration for curriculum and instruction since teachers alternate which grade level they teach each year. In the middle school grades, the focus for the two teachers is on content specialties and they work closely with each other to create large blocks of time for instruction as well as freedom to rearrange the schedule entirely for major projects and outings. Both the elementary loop and the

middle school block scheduling model at Northland make it possible to get entire classes of students outside for extended periods of time. Eric explained that this was a very intentional aspect of the school's charter, which the founders believed was necessary:

> We wanted to teach at a place where we had freedom to teach. And when we left the schools that we left, the vast majority of the teaching day was spent on reading, writing and math, and there was very little teaching of social studies and science.

He went on to emphasize that the curriculum at Northland does include a significant amount of social studies and science, which builds reciprocally with the focus on time spent outdoors. The day I interviewed Eric, his class had just spent the afternoon out on a nature walk. He told me:

> Today was an amazing walk. We're out there and there's a fresh dusting of snow. We've got animals, we've got birch seeds, we've got spruce seeds and kids are getting excited. And that's what I'm looking for.

Expeditionary learning. For Lynn, Northland's charter design provides her with freedom to get students out on more significant expeditions, which she believes can make a lasting contribution to a person's development of ecological literacy, especially when she is able to make curricular connections to science and social studies. She shared one example with me:

> We went to the mountains last spring—I did a ski trip, and I brought in some local resources. The BLM [Bureau of Land Management] came in and told them how they built all the cabins. They learned a little bit about ANILCA [the Alaska National Interest Lands Conservation Act] and how the land was set aside during ANILCA. So the students got a little history lesson in the cabin.

Just a few weeks before I interviewed Lynn, she had helped lead a week-long trip to coastal Alaska with the entire 8th grade class, where students camped out and spent their days immersed in lessons about coastal ecology. As the middle school social studies and language arts teacher, she focused on regional geography and current environmental issues while on the trip, as well as student writings and drawings in their naturalist journals. Lynn is deeply committed to providing more and more of these types of expeditionary learning experiences—similar to Outward Bound programs (see outwardbound.org)—to the students at Northland. She explained to me that this could also be an excellent way to focus on local and Indigenous knowledge: "Maybe one unit for me would be, you know, if we're studying Alaska maybe we go to each region and do something, and we're reading about the authors and the Native cultures."

Real-world connections. It is clear that the efforts of Northland teachers to get their students outdoors also has to do with making real-world connections to their school curriculum. When Denise and Eric take their young students outside on nature walks, they often allow the students' interests and curiosities to guide the focus for relevant ecological instruction. They know that this supports student enthusiasm and also helps students to see how they are connected with the world around them. At the middle school level, Lynn develops these real-world connections further, designing elaborate class projects of significance and relevance to the students' lives. They discuss sustainable food possibilities for the region, energy and resource use issues, and they design "Future Cities." She explained the "Future Cities" project to me:

> The kids love it—thinking what a future city might look like. Discovering all the different ideas that are out there currently. This year I'm making them do one for our town, in the future…so they have to think about what a city is and what a city needs.

On their overnight outings, Lynn draws on local resources and focuses on the unique aspects of the places they visit. She also builds in practical skills and immediately useful real-world connections. She told me that this works especially well when students work together to solve problems and develop these skills alongside one another:

> …that was part of my final, could they build a fire? And what materials work best? …the kids learn from each other, really. I'm just the guide and they're all in it together and they all have something to offer.

For all three of the research participants from Northland, they know that students will best remember what they learn when they can see it in action. Eric said: "I think where it's really powerful—what really is helpful—is if we talk about it in the classroom and then we see it outside. Then I think it's really, really rooted." Helping students to make those types of lasting connections between what they learn in the classroom and the real world outside of the school can support their development of ecological literacy and environmental citizenship as they come to understand the greater context within which their lives are situated.

Place-based curricula. As I pointed out above, the Northland teachers all explained to me that they strive to provide opportunities for student interests and questions to guide instruction, especially for ecology investigations. In terms of planning for ecological literacy in general, the participants described to me that a lot of this was done up front, when the school was first started, so they have been able to focus their energy on continuing to find new ways to connect

the local environment and community to the curriculum. Eric did clarify, however, that this was a lot of work initially: "So in terms of how much preparation and planning, I've done a ton of it because we wrote the curriculum. Almost everything we learn about in social studies and science has no textbook." The reason there is no textbook for these subjects is because the Northland curriculum is place-based, grounded in the context of the immediate surroundings, and textbooks produced on a national level by a far-off publisher would be largely irrelevant. This approach is the basis for place- and community-based education, and until more local resources and curricular materials are developed, it often places the responsibility on classroom teachers to create materials from scratch (Gruenewald & Smith, 2010; Sobel, 2004; Stone & Barlow, 2005).

School demographic. The teachers at Northland Charter School have a number of things in their favor when it comes to fostering ecological literacy in students. For instance, the school serves a slightly greater percentage of middle- to upper-class families than some other local schools, according to the teachers. The school is open and very welcoming of all students in the district, but there may be several partial explanations for the mildly skewed demographic composition. Like other charter schools in the same district, the school has a policy in place to guarantee a space for siblings of current students. This policy is meant to support parents in arranging transportation because, as per the charter agreement with Northland, the district provides none. This in turn means that the limited number of available spaces at the school, especially in kindergarten, go to new students who have siblings already in the school. Furthermore, for families who rely upon district-provided transportation or public transportation (which does not reach Northland), enrolling their students at this particular charter school may not be feasible if they are unable to arrange daily transportation themselves.

Parent involvement. According to the three teachers from Northland, the school's demographic tends to include parents who are more involved in their students' education than at other schools where they have worked throughout the district. It is generally believed by the teachers that parental involvement helps to foster ecological literacy in students for several reasons: close parent involvement could add further support for ecological literacy development; these families tend to spend more time outdoors, outside of school; the basic needs of students (i.e. food, clothing, rest) are generally met by most families; and parents have the means to provide their children with adequate clothing and equipment to be outdoors so that they can participate comfortably and safely in the wide range of school activities. This is not to say that

Northland teachers don't face their share of challenges as well. Both Eric and Denise commented on how it is not atypical to have students who come to school unprepared, or without adequate food and rest. Without these basic needs fulfilled, students are often unable to participate or focus on the activities of the day—especially at a school that spends so much time outdoors.

Small school size and long-term relationships. Another feature of Northland Charter School that undoubtedly contributes to the teachers' ability to foster ecological literacy is the fact that it is a small school and, in the best case, students are there for nine years. This long-term relationship between student and school is conducive for supporting students in developing emotional bonds with the natural world as well as deeper understandings of ecological principles and interconnections. Denise offered one example of being able to see student growth over the course of their years at the school:

> Just the other day, there was a teacher that had my kids last year; they went to a place we used to go all the time and they were like, "Oh! We used to come here all the time! We *love* this place!" You know, just that there are places in the natural world that they have a real emotional attachment to and that hopefully then later they would really care about.

As discussed above, the teachers believe that ecological literacy develops over a long period of time. Therefore, in a small school with a mission to foster a sense of place and environmental citizenship in students, and where they could remain for up to nine years, it is possible for great progress to be made in this area. This is especially true when teachers collaborate and have a similar long-term goal in mind for students. Eric spoke about this also being a benefit in terms of having some way to track student development of ecological literacy:

> I guess the best way to assess is "What are they doing with it? Are they doing anything?" So I'm trying to get kids excited about the outdoors…and being out there. So I look at those kids as they go through 8th grade. Are they still excited about being outdoors? Are they still doing things with their family? Are they getting out? I don't have a test-score assessment of it…What are some of the applied projects they may be working on in class? You could look at it over a timeline.

When teachers are able to witness the long-term development of ecological literacy in youth, they are better positioned to understand the types of methods and instructional strategies that have a greater chance of being successful.

Young age of students. Perhaps the most substantial factor that supports the development of ecological literacy in students at Northland Charter School is that the school serves kindergarten through 8th grade. In some respects, teaching at a K-8th school takes some of the pressure off for high-stakes standardized testing, and more notably, there is no concern for high school graduation expectations. Most significant, however, is that the younger age of students at Northland means that they are in a different place developmentally than students at a school such as First Light Charter School, which serves 7th-12th graders. These younger students are still developing a set of values as well as foundational aspects of their personal "environmental identities" (Green et al., submitted for publication), which could mean that the influence of their schooling at this younger age could be profoundly more significant. The Northland teachers seem to hold this belief as well, which may strengthen their drive to contribute to their students' development of ecological literacy. Eric stated:

> I guess to me I want my kids to be immersed in the outdoors because I think if you don't do it at a young age then you don't do it. That's what it comes down to for me. And I think that's why this school is really important.

Lynn also holds a similar conviction that the sense of connectedness that is an integral aspect of ecological literacy begins early in one's life:

> It starts really young—even my daughter in kindergarten. She's outside right now with her father on a moose hunt. There are a lot of kids at this school and especially in the bush where it starts at a young age because they are connected to the land a little more and they're out in it more and it makes them happy.

Emotional bonds. One of the reasons why the three research participants from Northland Charter School believe that it is necessary to begin fostering ecological literacy in children at an early age is because of the emotional bonds that can be formed at this time in life. Denise talked a lot about the importance of these emotional bonds and how she seeks to nurture them with her primary school students. She described to me a central subject for her class each year:

> We pick a birch tree every year and we name it through a very thoughtful process, and we observe it. We sing a song to it every week; we collect its seeds. I mean, so one thing is just by getting an emotional attachment.

Denise has developed this approach by following examples from the One Tree program (see www.onetree.org.uk/). In addition to adopting a birch tree, her students also take care of a small

menagerie of class pets, including four egg-laying chickens that live in a coop right outside the school. She believes that this helps the children to acquire a very strong sense of empathy for other living creatures, which Sobel (1996) explains is a necessary precursor for people to develop positive connections with the natural world. For Denise, unstructured outdoor playtime for her primary school students is also a means for helping them to form positive emotional bonds with the natural world. She reminded me that this type of free-play helped her to develop ecoliteracy:

> I always have to remind myself that, you know, they had recess time but we need to have recess time in the woods. So that we say, "Okay now, we have a little while, these are your boundaries. What do you want to do?" Because if I keep the day structured, and we only play in the playground, and the only time we're outside we're doing things, then I'm taking away the one way that I got it.

Denise firmly believes that children should be encouraged to play creatively outside, with little or no intervention from adults aside from ensuring their safety.

Empathy. Eric and Lynn also specifically mentioned the importance of empathy in fostering ecological literacy, and like Denise, they explained that Northland has adopted Sobel's (1996) viewpoint that the youngest children do not need to be unreasonably burdened with the "doom and gloom" of global environmental problems. Instead, through nurturing empathy for other creatures and a "sense of wonder" for the natural world, positive associations will blossom and lead to ecological literacy and a desire to take action. Eric summed this up wonderfully:

> My piece is not to tackle the problems with the environment and solve the problems of the environment. It's more to get you to *enjoy* the environment, to understand that this really is worth protecting. This is really something worth fighting for. But you gotta love it, and if I can get you to love it, then you're going to stand up for it and you're going to do things to preserve and conserve it. So that's kind of what I feel my role is at this level.

Eric is very cautious not to force any opinions or beliefs on his elementary students when they do make a point to discuss local ecological issues such as natural resource use. He explained:

> I want it to be something that they develop on their own. But I want to give them something. I mean I think they're doing that when they're out there, but I'm not guiding them to it and I really am hesitant to do it at this age because I don't think that they're critical thinkers enough. I think it just becomes parroting the teacher.

In both Eric and Lynn's classes, students are presented with a fair and balanced approach to relevant environmental issues as the teachers strive to minimize their voice and statements of personal opinion. This is consistent with the recommendation of Berkowitz et al. (2005) who say that efforts to foster environmental citizenship should be open-ended with respect to the values that are promoted. Instead, students should be encouraged to examine their own values.

The emotional attachments to the natural world that young children discover likely go a long way to help them develop a healthy environmental identity through trusting in nature (Green et al., submitted for publication). In this way, Denise hopes that her students will begin to see themselves as *part of* the environment because "we all need to know where we fit in." She trusts in her ability as a primary school teacher to make a positive contribution to this development in her students, explaining it this way to me:

> It's just the little things that we can control and contribute to. I think in terms of primary school, for them a lot of it is feeling that they're part of something bigger. The good part, the perspective of: "I'm a tiny thing, but I'm still part of all this." And then the part that "I can make a difference."

Sobel (1996) offers this advice for educators: "What's important is that children have an opportunity to bond with the natural world, to learn to love it and feel comfortable in it, before being asked to heal its wounds" (p. 10). The teachers at Northland Charter appear to be following a similar formula for fostering ecological literacy in youth: 1) instilling a sense of wonder for the natural world during the earliest years of schooling; 2) serving as role models who demonstrate care for nature; and 3) encouraging students to believe that they can make a difference.

Challenge: Role of local and Indigenous knowledge. The one area in which Northland Charter School seems to have more difficulty with regard to fostering ecological literacy is in developing the role of local and Indigenous knowledge. As detailed in the review of literature concerning ecological literacy, LIK must be called upon as a complement to Western educational traditions. It is the "long inhabitation" of particular places that characterizes LIK, and from which great wisdom and some of the strongest examples of ecologically literacy can be found (Barnhardt & Kawagley, 2005; Cajete, 2005). At Northland, there is a clear emphasis on local knowledge, especially with regard to the science of ecology and issues of social concern, but it has been more challenging to connect youth with sources of Indigenous knowledge. According to Eric:

> It's not like First Light where it's the fabric of their school. We do talk about that—we do talk about Native ways of knowing things and seeing things. That's a part of the discussion, so that cultural piece does occur, but it's more taught from an outsider's perspective.

It is certainly promising that teachers at Northland strive to include discussions around other ways of being and knowing. The challenge might be in validating Indigenous epistemologies by offering an accurate, balanced perspective, for *not* to do so is to perpetuate the dominant Western worldview (Battiste, 2008; Greenwood, 2013). Again, as evidenced in the literature, this may prevent an individual from being capable of developing their ecological literacy to the fullest.

For teachers at a K-8th school such as Northland Charter, presenting alternative ways of knowing may be slightly impractical. This could be especially true for the youngest age groups who may not have a firm understanding of their own heritages and backgrounds nor the ability to think abstractly enough. Lynn explains that this is even a difficult task for middle school:

> Some students are really connected to their backgrounds and they know where they come from and who they come from and some kids don't. So that is tough for some kids that don't know these things. We've done some of that—family history or oral history projects—and I've seen both things happen. But yeah, discovering that sense of self and where you come from is important.

This seems to be an excellent starting point for any classroom and any teacher, regardless of their own cultural heritage. Having taught for six years in a rural Alaskan village, where she helped to establish a local culture camp led by Native elders, Lynn is in a good position to offer recommendations to colleagues for appropriate ways in which to call upon LIK as a counterpoint to traditions of Western knowledge. She admits though that teaching in an urban setting can be an impediment to this process:

> Working out in the bush, you see it there more so because you're more in tune with the natural surroundings. Whereas in the city you get away from that a little bit—you know you're in the classroom, surrounded by walls.

She continued, however, and explained that choosing a more broad perspective and focusing on the shared experiences of local places can help:

> It's place-based, defining place as the people as well as the environment. Place is also about your community—what it means to be part of a place isn't just about your environment but about the people and the culture and what that culture can be.

This is the approach that Denise strives to take in her teaching. She explained to me about her primary school class: "We don't know too much about what we don't see. So one of the big things we do is…trying to get someone from every family to come in and do something with us." In this way, Denise hopes to broaden the perspectives and understandings of her young students, with the belief that this will nurture in them an openness and sense of respect for difference.

Conclusion. Overall, the three research participants from Northland Charter School appear to be making great strides in fostering ecological literacy in children and youth. These teachers endeavor to nurture a sense of empathy and wonder for the natural world by providing abundant, meaningful experiences outdoors for their students, and they simultaneously serve as role models who care for and respect nature. Though it can be a challenge to develop the role of LIK in contributing to their students' ecological literacy, they are nonetheless aware that their students should learn to respect and maintain openness to other perspectives and ways of being and knowing. As these teachers continue to find ways to make real-world connections, grounded in experiences of the local community and environment, there is little doubt that their students will have the capacity to become strong environmental citizens with a firm foundation for ecological literacy.

Case #2: First Light Charter School

First Light Charter School serves 7th-12th grade students, with a mission to provide them with instruction that is rooted in local culture and presents Western and Native ways of knowing as equally valid paradigms.

School size and demographic. Like Northland Charter, First Light provides a rather small school setting, with an enrollment of approximately 175 students. First Light is able to serve a more diverse population of students than Northland because the school district provides bus transportation to and from the school. Additionally, the public bus has a service that passes nearby the school. With an intentional focus on Alaska Native culture—which the majority of students identify with to some extent—the school's hallways and display cases exhibit a variety of Alaska Native art and tributes to local culture bearers and leaders. Much of the student work that is on display depicts various aspects of Alaska Native traditions and cultural values, and some is even presented in the students' Native languages. It is clear that students at First Light are encouraged to take pride in their cultural heritage.

Difference between middle school and high school. The middle and high school grades at First Light are separated into two wings within the same building. When one enters the main doors, turning one direction leads to the 7th and 8th grade classrooms of the middle school, while turning the other direction leads to the 9th-12th grade high school wing. On the middle school end there are two teachers per grade level, and these teachers collaborate closely and co-plan for most subjects and elements of their curriculum. For the most part in the high school, each teacher is responsible for his or her specific subject area (i.e. science, math, language arts), and the students rotate through these classrooms throughout the day for a total of five periods per day. This is similar to the mainstream high schools in the district, but the smaller class sizes at First Light allow for more differentiated instruction as well as greater flexibility in student schedules throughout each school year and over the course of a student's high school career.

According to Lucy, who helped draft the original charter at First Light and has worked there since the school opened, there are distinct differences between the middle school and high school. One significant difference, she states, is that the middle school teachers have been able to focus more on local and Indigenous knowledge in their instruction. There are several possible explanations for this, including teacher backgrounds and comfort levels as well as greater pressure in the high school due to graduation requirements and early college course offerings. Whatever the reasons may be it does seem to create a minor division at the school, where the middle school students receive instruction with a stronger grounding in LIK.

Role of local and Indigenous knowledge. In some respects, First Light Charter School is in an excellent position to foster and strengthen ecological literacy in youth. The school's emphasis on Native ways of knowing and LIK provides the foundation for ecological literacy to be developed. As thoroughly discussed in the literature review, Indigenous worldviews are characterized by long traditions of direct experience in the natural world, and one could argue that they represent the strongest examples of ecological literacy. Though it can be difficult to translate LIK into day-to-day classroom instruction, even at First Light, the fact that it is an explicit topic of discussion and instruction carries great weight. For example, the school has adopted a set of "Cultural Values to Live By" (Table 3) that are on display in every classroom and hallway at First Light Charter School and are referred to frequently. They include many values and mindsets necessary for ecological literacy and environmental citizenship, including respect for nature, respect for others, and responsibility.

Table 3. "Cultural Values to Live By" at First Light Charter School

Respect for Elders	Respect for Nature	Respect for Others
Sharing	Love for Children	Providing for Family
Wisdom	Spirituality	Responsibility
Unity	Compassion	Love
Dignity	Honoring the Ancestors	Honesty
Humility	Humor	Knowledge of Language
Caring	Cooperation	Endurance
Hard Work	Self-Sufficiency	Peace

Despite the structures in place, it can still be a challenge to develop a deeper understanding of these cultural values in students. This can be especially true in the high school grades with demands for conventional academic preparation for Western institutes of higher education. Also, these values are derived from sets of traditional Alaska Native values, and not all of the students at First Light Charter School come from an Alaska Native background. However, Lucy points out that these values are applicable for all students:

> I think every student, regardless of whether they're Alaska Native or not needs to be aware that they come from a culture and that they're not just born in a city—their family came from some place. At one point in time, people were tied to the land.

Lucy seemed to indicate a belief that to be ecologically literate, a person must maintain some connection to the land and that traditions of LIK have the capacity to foster such a connection.

Real-world connections. First Light Charter School's explicit focus on instruction grounded in local culture and LIK also leads effectively to exploring real-world connections and spending time outdoors. Interestingly, while the three teachers from Northland Charter discussed the time outdoors theme the most, the three participants from First Light focused more on making real-world connections with their curriculum—particularly through local culture. One of the possible explanations for this difference could be the ages that each school serves. Northland, with the younger spectrum of students, chooses to focus on developing positive associations with the natural world. At First Light, with middle and high school students, the focus is on the practical and traditional applications of knowledge and understanding. Lucy offered many examples, including this one:

> We start off small this time of year with a medicinal plant unit, where we take the junior high students out camping all together. They have a lot of activities that they need to do:

> gathering plants, identifying them, which ones they'll use for their future project. They'll end up with at least 10 plants, being able to tell you the medicinal use of them, know the native name, common name and scientific name.

Lucy told me several times about how she provides exposure to other relevant traditional practices, especially for the many students at First Light who have been born and raised in the urban setting: "You know when I gut beavers out here, and I skin grouse and we cut up moose heads, tan hides—that's completely widened their worldview because they don't forget that."

For Julie, who teaches high school science, the real-world connections that she makes with her students are generally tied more closely to state standards for these science subjects. However, she explained to me that she tries hard to integrate the students' knowledge of subsistence practices whenever possible:

> Well we definitely talk about what they see when they go out to their fish camps, or we talk about hunting moose all the time…This project [holding a student work example of a plant taxonomy project] was specifically on native plants—their plants—looking at their Native names, and then characteristics and maybe Native uses of the plants.

A project such as this also likely draws upon students' prior knowledge, whether it is what they gained in Lucy's class in a previous school year, or through their participation in harvesting and utilizing plants for traditional uses. Julie does a lot of structured labs for her science classes, but she also described to me how she is attempting to broaden the scope of those labs to include perspectives outside of Western science. She explained an example of her tentative class final:

> My biology students have to come up with their own project, experiment, or lab, and I'm going to try to challenge them to come up with a way to do it with as little impact as possible I suppose. So I guess in that way that's a big part of environmental awareness as well as traditional science.

Julie also does a natural resources unit during earth science class in which the students research and discuss energy resources that are used in Alaska as well as possible alternatives. Again, all of these choices are concerned with approaching school curriculum through a relevant, local lens, and they provide students with meaningful real-world connections to the material.

Carol, as discussed above, serves as the early college coordinator and general support staff for instructional activities at First Light. In this role, she has the freedom to dream big in order to come up with course offerings and projects that offer many real-world connections for

students' sake. For instance, she helped to launch the school's chapter of Future Farmers of America (FFA), which helps support a school garden and that focuses on food justice issues as well as subsistence traditions. She described this as a means for making strong connections:

> Ask these kids where they get their food: "Have you ever gone hunting? Do you collect berries? Do you gather? What's your favorite food?" [Student response:] "Oh I love moose." Most of our kids here have some kind of connection with food. It all comes back to food. I mean it's all about food. It's all about shelter...In the big picture you have to get kids to connect with where they are.

Carol described a course which another teacher at the school leads, and which she has had the opportunity to help with:

> Jeff teaches Arctic survival. You have to show them something. We had two kids that had taken the class, and they were out in Western Alaska visiting grandparents, and they got lost and that class saved their lives. *That's* practical education.

In addition to her zeal for providing real-world connections for youth in order to foster ecological literacy and to provide a meaningful education, Carol is also unwavering in her belief that students must spend time outdoors in natural areas. She said: "One of the things that we lose is because we teach inside. Since when did biology become a textbook? I don't know but it's not how you teach biology. You have to get kids out." She returned to this conviction on numerous occasions, and it is one of the guiding principles for her work as an educator. When I interviewed her, she was in the midst of designing a major project to restore the park surrounding First Light that serves as a riparian zone for the slough that runs through it.

School location. Another factor to develop ecological literacy in their students that seems to work in the favor of the teachers at First Light Charter School is the school's location. Carol's project to restore the park surrounding the school is an excellent example of a project that could contribute in a substantial way to students' ecological literacy. Because a park with native flora surrounds the school, it provides a great setting for observing the natural world. Julie explained: "We have the view—we can talk about the snow, we can talk about the weather, just because we're actually watching it happen. In that way, I use what I can."

Holistic approach to teaching. A final factor for supporting students in developing ecological literacy that is in teachers' favor is the freedom they have to approach teaching and learning holistically. This is especially true for the middle school grades. With a focus on the ho-

listic traditions of LIK, it is only natural that teachers would think of their instruction in a similar manner. Lucy explained the middle school teachers' current discussion about how to instruct social studies and science:

> I think what we'll probably end up doing is just doing social studies and science together—meshing it together instead of doing separate things. I just can't quite compartmentalize. To me it's connected…When you're talking about cultural knowledge, that's the social studies part. And then in science you talk about applying the cultural knowledge…how did traditional Natives find out this information? Well, here's their history and then here's how they did it. So it's all so connected.

This type of holistic thinking is characteristic of Indigenous knowledge systems and supports the systems thinking framework (Barnhardt & Kawagley, 2003). Furthermore, it prevents the compartmentalization of knowledge that is distinctive to the dominant Western paradigm and which perpetuates the status quo in institutions of formal education (Barnhardt, 2002). Place- and community-based educational strategies that can nurture ecological literacy should be grounded in holistic, systems thinking, and First Light is striving to provide this type of instruction for students (Gruenewald & Smith, 2010; Stone & Barlow, 2005).

Challenge: Family circumstances. On the other hand, there are a number of unique challenges facing teachers at First Light Charter School with regard to developing ecological literacy in their students. According to the teachers, a significant portion of the student population is from middle to lower-class families, and basic needs can sometimes be difficult for these families to provide their students. Lucy believes this can be a major impediment to fostering ecological literacy:

> There are plenty of people out there for whom that [ecological literacy] is not their goal. There are plenty of people out there whose goal is to make enough money to put food on their table—that's their priority. They need to pay for their healthcare; they need to pay for their children's shoes, their gas money. Some of our parents don't have enough money to take their kids grouse hunting, because you can't grouse hunt in the city. Even going berry picking—it's such a big issue.

Many parents work long hours and they may not have the freedom to be able to participate closely in their child's schooling or support their development of ecological literacy by taking them out of the city to more natural settings, as Lucy explained above. For Lucy and Julie, this chal-

lenge at times sounded insurmountable in terms of finding success fostering ecological literacy. Indeed, Lucy views the family as one of the primary leading factors for how youth develop ecological literacy. Her response to my question, "How do you think youth develop ecological literacy?" was as follows:

> I guess I'd have to say, boy I hope that comes from the family. That would be the number one wish, is that it's family. You know—parents, guardians, whomever family is. All we can do, as we talked about, is foster it—trying to let them know, how to verbalize it, what living in place is, what sense of community is, and so they just get it reinforced.

Though family situations are largely out of their control, the teachers at First Light did express serious concern that it is a major barrier for fostering ecological literacy. It is possible that part of the reason for this is that these teachers do not receive students until they are entering the 7th grade or later, and it may be harder at this stage to shift one's values in an alternative direction.

Challenge: Developing ecological literacy in an urban setting. First Light is able to provide district-sponsored transportation for students, which makes the school more accessible for youth from across the district's coverage area. However, the teachers explained that the majority of youth come from particularly urban and developed areas, which can make it hard to relate dimensions of ecological literacy to students in the school setting. In reference to the role of LIK in fostering ecological literacy, Carol explained the advantage of being in a rural village setting: "Alaska Natives out in the village, some of them—those kids get it. They get it because they harvest caribou right now. People who live a subsistence lifestyle, they get it." Julie also recognized this same challenge for urban teachers:

> The students who have lived in the villages obviously have a different view. They're living subsistence, or are more subsistence-based… In town, it is much more urban. Most of them, they're not nearly as aware, I guess, of what's going on around them, outside.

Lucy had similar concerns to share:

> It's hard when you're living in an urban setting. I mean your sense of place—it's clouded. Buildings and buses and cars. It's a lot easier to get your sense of place if you have an opportunity to go camping, go back to your village. But I mean, really, if you lived in a city, your sense of place would be completely different from mine, and I'm the one who's trying to foster that in them. And I don't understand the sense of place if you live in a city because I've never really lived in a city.

Despite the challenge that the urban upbringing and culture of their students presents, the three research participants from First Light are nonetheless persistent in their efforts to expose the students to time spent outdoors in natural areas and traditional subsistence practices. Carol summed this up somewhat humorously, but also seriously: "Start off small. Let them take their phones, but get them out there."

Challenge: Older age group. With the older age range of students at First Light Charter School, ecological literacy may be difficult to foster as this age group tends to be more set in their personal values, based on other influences in earlier stages of their lives. Also, as discussed above, pressure for college preparation and fulfillment of graduation requirements in the public school setting could take away from a focus on ecological literacy. Though they did not refer to this challenge directly, all three research participants attributed much of their personal ecological literacy development to spending time outdoors as young children. The activities and experiences they discussed continued through adolescence and adulthood, but the foundation had already been laid for its development. Again, this is not to say that it is perceived as an impossible obstacle to overcome. Lucy explained that ecological literacy can still be nurtured by providing alternative viewpoints:

> So with them, trying to get them up and down and sideways, increasing their worldview. And you can see that—they do. But I won't say that all of a sudden I have these students who are going to take their kids out hunting because they did it in middle school with their teacher.

The unique obstacles that face the teachers of First Light can indeed make it difficult to support their students in developing ecological literacy. However, these hurdles are not insurmountable, and these individuals strive to overcome them through their hard work and determination.

Conclusion. Ultimately, the three research participants from First Light Charter School appear to be doing an excellent job of fostering ecological literacy in their students. Though there are a number of difficult circumstances facing them in regard to this task, they are up to the challenge. The school's mission to provide students with instruction grounded in local culture and traditions of LIK is a perfect starting point for students who may not feel immediately connected to the natural world. As teachers make real-world connections between curricular topics and traditional practices, students are engaged and more capable of understanding key principles of ecology and how they might live their lives in accordance with them. Additionally, a focus on

cultural practices of subsistence can encourage teachers and students to spend time outdoors in natural areas, engaged in meaningful learning and interacting with adults who are role models for care of the natural world. The teachers of First Light are in an excellent position to nurture a deep and lasting form of ecological literacy, grounded in LIK and the "long inhabitation" of a particular place.

Impact on Student Learning

In addition to the findings generated by the semi-structured interviews and the accompanying fieldnotes, a small sample of relevant student work was also collected from each participant for analysis. This section will highlight several work samples as evidence for the impact on student learning that can result from instructional methods for fostering ecological literacy. These findings also address the research questions, "How is ecological literacy fostered in two Alaskan public charter schools?" and "What are effective teaching methods and what are the challenges in engaging students in ecological literacy?" because they demonstrate assignments and projects that teachers in these two schools are employing to foster ecological literacy.

Before the analysis of student work samples can be shared, it is necessary to provide a framework that could be applied as a measure for the development of ecological literacy. As yet, there are no widely agreed upon means for assessing an individual's level of ecological literacy. Furthermore, Berkowitz et al. (2005) point out that ecological literacy, like environmental citizenship, does not develop along a linear timeline, but instead it is comprised of overlapping and interrelated components. For these reasons, I believe the Environmental Identity Development model discussed in the literature review provides a useful framework for analyzing the examples of student work (Green et al., submitted for publication). To me, this model represents the core of ecological literacy as Orr (1992) intended, and it will be used as lens through which to present the findings relevant to the student work samples collected for this research.

Teachers at Northland and First Light Charter Schools are contributing to students' development of healthy environmental identities—whether they are aware of it or not—by providing educational opportunities in, about, and for the environment (Green et al., submitted for publication; Lucas, 1979). Students are supported in developing a sense of trust in nature, spatial autonomy, environmental competency, and in some cases, a disposition for environmental action (Green et al., submitted for publication). The following student work samples provide evidence for these teaching practices.

Figure 4. Aphid galls collected by Denise's primary school students at Northland

Figure 4 shows an example of education in and about the environment from Denise's classroom at Northland. Her class began collecting aphid galls after one student noticed the strange growths on a walk through the nearby forest. This class project appears to demonstrate that the students have achieved a level of trust in nature that enables them to interact positively with the natural world (Green et al., submitted for publication). We also have a sense that the students are building their collective environmental competency by taking part in the project.

A second student work sample that provides evidence of education in the environment is from a nature journal kept by a student in Eric's elementary class at Northland. Figure 5 shows this student's reflections from two nature walks with the class, which seem to exhibit trust in nature, captured in the positive descriptions of the experiences and an obvious level of comfort in

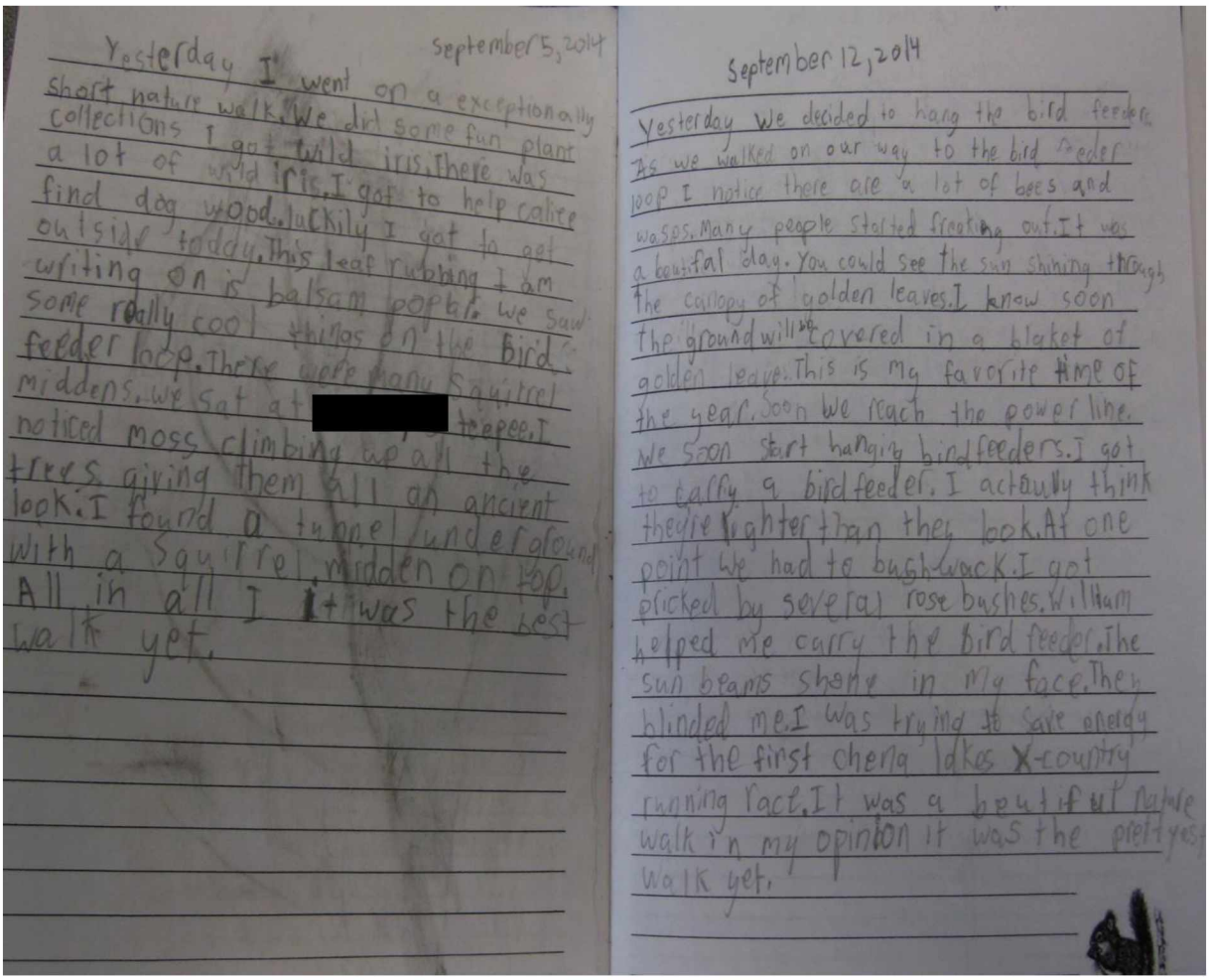

Figure 5. Nature journal entries demonstrating education in and about the environment

the natural world. The student writes: "You could see the sun shining through the canopy of golden leaves. I know soon the ground will be covered in a blaket [*sic*] of golden leaves. This is my favorite time of the year." This sample also appears to demonstrate education about the environment, as this student displays a measure of environmental competency by identifying names and key habitat features of local flora and fauna. Finally, we gain a sense that this student has at least some feeling of spatial autonomy while immersed in education in and about the environment, as s/he is quite comfortable moving about the natural world.

The next student work samples, from students at First Light Charter School, also show engagement in the first three stages of the EID model. The left side of Figure 6 shows the photo

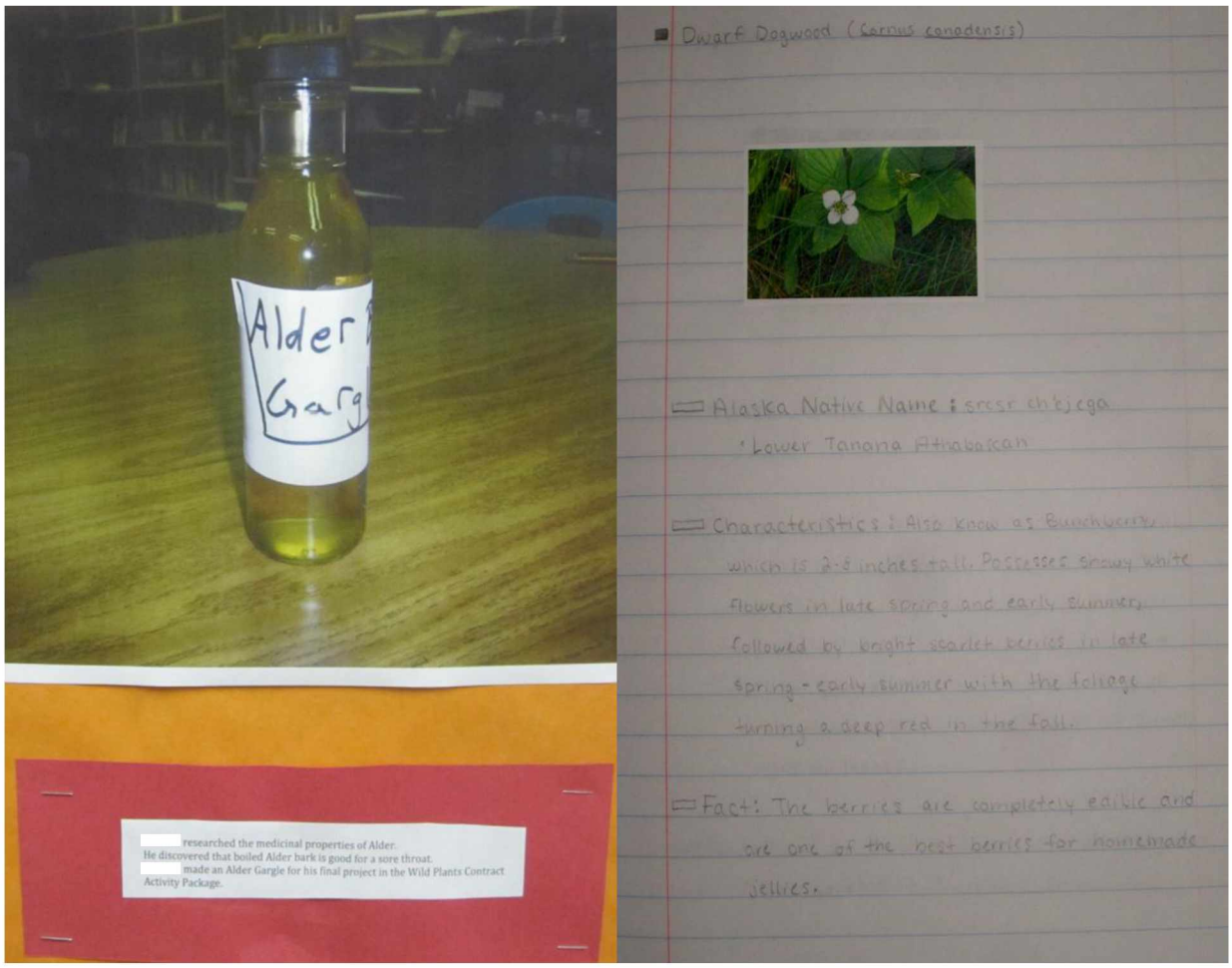

Figure 6. Native plant projects from students at First Light Charter School

and project description from a student's medicinal plant project for Lucy's middle school class that were on display in the hallway at First Light. The description below the photo reads:

> [Student name] researched the medicinal properties of Alder.
> He discovered that boiled Alder bark is good for a sore throat.
> [Student name] made an Alder Gargle for his final project in the Wild Plants Contract Activity Package.

In this example, which reveals the significant role of LIK at First Light, the student is demonstrating environmental competency with this knowledge of an important medicinal use of a local tree species. Clearly, the student had to be able to identify the alder tree and also spend time in the environment in order to collect the bark. This example also shows a certain level of spatial autonomy through the student's interactions with nature. The right side of Figure 6 shows an ex-

cerpt from a native plant project completed by a student in Julie's high school field ecology class. Like the previous work samples, this also demonstrates education in and about the environment, and the student clearly displays a level of environmental knowledge about the plants that were studied for the project. In the excerpt, the student share the Athabascan name for dwarf dogwood, as well as a traditional use of the plant: "The berries are completely edible and are one of the best berries for homemade jellies."

The final stage in the EID model from Green et al. (submitted for publication) is environmental action stemming from education for the environment (Lucas, 1979). It is quite likely that this stage may be the hardest to foster—or at least witness—in the public school setting. There are several possible explanations for this challenge. First, environmental identity development takes place over the course of one's lifetime, and it will not happen at the same rate for every person. Therefore, some students may not reach the level of environmental action before they have completed their formal schooling. Second, as Green et al. (submitted for publication) point out, one must achieve trust in nature, spatial autonomy, and environmental competency *before* they are able to practice environmental action to its fullest. These prior stages form the foundation for action. Finally, as Eric pointed out in his interview, there exists an ethical dilemma of what values to promote (or not) with regard to environmental action. Berkowitz et al. (2005) have also suggested that learners should be given "the freedom, guidance, and opportunity" to develop their own value set, which emerges within a larger social context and is certainly not limited to schooling (p. 229).

With these considerations in mind regarding the emergence of environmental action amongst youth, it is not surprising that there were not many samples of student work collected that reflect this stage in the EID model. However, it was evident in talking with teachers that many of them strive to incorporate projects that demonstrate education *for* the environment. For example, Carol is currently developing a project to restore a local riparian area that is enclosed in the park surrounding First Light Charter School. In Denise's primary school classroom, students are taught that they need to care for the birch trees of the northern forests because they provide humans with necessary oxygen and numerous other services. Finally, Figure 7 shows two examples from Lynn's middle school class at Northland. On the left side is an excerpt from a student's naturalist journal, recorded during a weeklong class trip to coastal Alaska. At least in theoretical terms, the student's writing and choice to include this particular quote from Rachel Carson seem

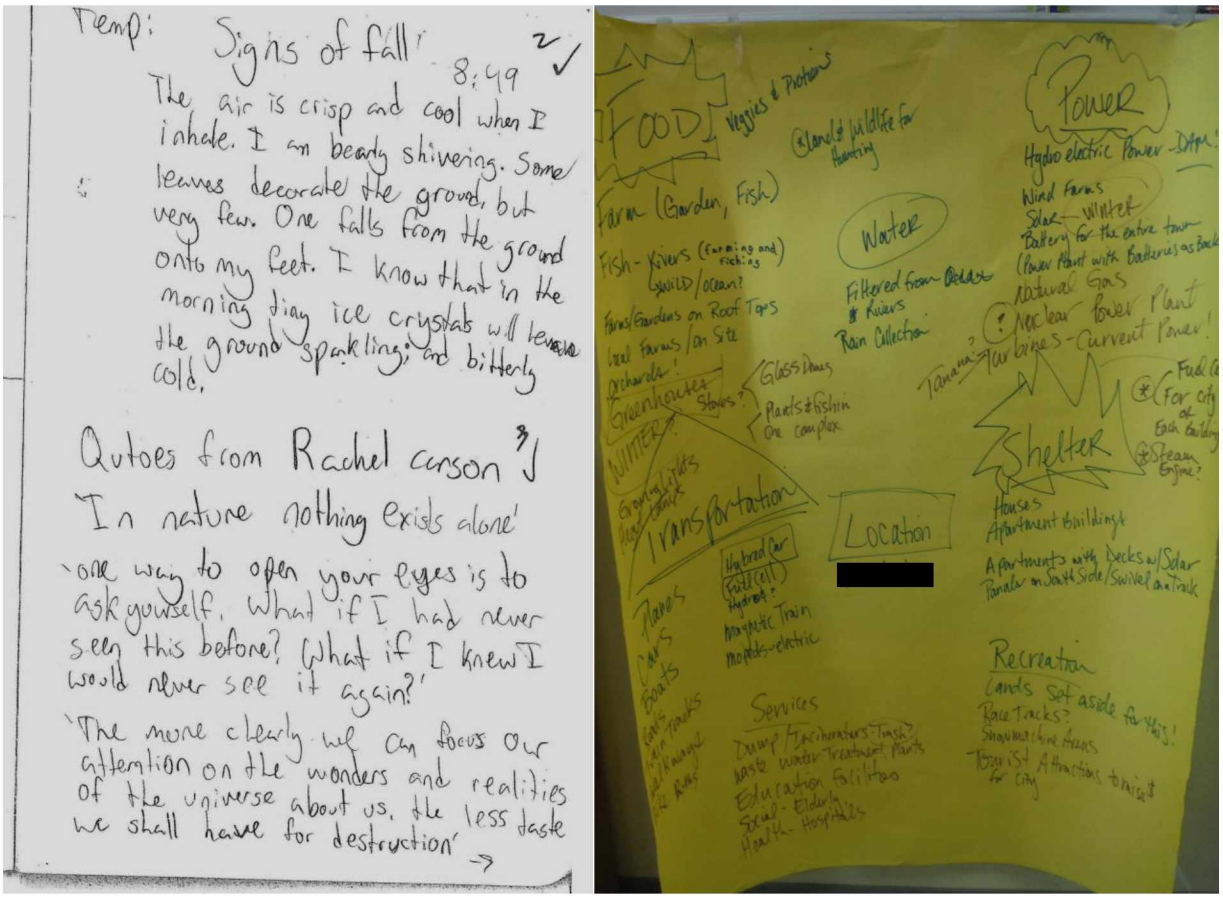

Figure 7. Student work samples demonstrating education for the environment

to demonstrate a degree of environmental action. On the right side of Figure 7 are sustainable systems designs for the local community, brainstormed by Lynn's class as part of their "Future Cities" project. Though these examples do not show immediate action for their environment, they show evidence of educational efforts for the environment which foster ecological literacy and environmental citizenship, and which can ultimately lead to meaningful action.

Overall, I believe the samples of student work collected from the six teachers are strong illustrations of education *in*, *about* and *for* the environment that help students to develop healthy environmental identities. This in turn can lead to increased ecological literacy and, ultimately, environmental citizenship and participation in issues of local ecological concern. The final section will offer a concluding examination of the themes discovered through this research study, a discussion of the implications for public schooling in general, and several recommendations for the participating schools as well as for future research endeavors.

Chapter Five: Discussion

A growing concern for humans' detachment from the natural world has contributed to the emergence of place- and community-based educational approaches (Gruenewald & Smith, 2010; Sobel, 2004; Smith, 2002, 2007; Stone & Barlow, 2005). These pedagogical practices have the potential to reconnect children and youth with their local communities, both human and non-human, and to help them develop a deep awareness and understanding of their connection and role within these communities. Orr (1992) refers to this disposition as ecological literacy, while Berkowitz et al. (2005) have extended his original framework and refer to the revised model as environmental citizenship. Regardless of terminology, humankind's capacity to maintain a healthy and sustainable relationship with the rest of the natural world depends upon our collective understanding of the key principles of ecology and an overall ability to live in accordance to them. This is a necessary undertaking for our systems of public education.

This research study has sought to address three central questions: 1) How is ecological literacy fostered in two Alaskan public charter schools? 2) What are teachers' beliefs in these two schools about the way children and youth develop ecological literacy? 3) What are effective teaching methods and what are the challenges in engaging students in ecological literacy? By exploring these research questions, I have come to understand that the concept of ecological literacy is intricate and multi-faceted. For instance, the term itself can be disagreeable or misleading without providing a contextual framework. The model of environmental citizenship from Berkowitz et al. (2005) is a good starting point, although the necessary role of local and Indigenous knowledge should be included as well.

Educators may also have a difficult time determining whether or not they are fostering ecological literacy in their practices, which can cloud their understanding of what methods are most useful to this end. Most of the research participants made references to the challenges they face in terms of assessing ecological literacy in their students. There is little doubt that the holistic, interdisciplinary nature of ecological literacy, which develops over many years in a person's life, does not fit naturally into the linear and compartmentalized framework of public schooling. However, I believe that there are certain key aspects of ecological literacy that can be fostered within the school setting, and this research has served to capture several of these features in order to share them with others.

Themes from the Research Findings

Through the research investigation, I discovered that there are many different ways by which children and youth (and people generally) develop ecological literacy. However, there are several themes that emerged consistently amongst the research participants. For these six individuals, ecological literacy in their own lives developed over a long period of time, though almost without exception the seeds were planted at a young age with positive experiences outdoors in natural areas. It is also important to note that all of the participants made mention of the principal role that family—especially fathers—played in these experiences in the outdoors. For most, formal education did not play an important part in the participants' development of ecological literacy. This point deserves special attention considering this was a study of teachers' role in fostering ecological literacy in public charter schools. These three findings are consistent with the work of Chawla (1999, 2006) and Chawla and Cushing (2007). Another common theme that was heard throughout the interviews that is worth noting is the role of hunting in helping many youth develop ecological literacy.

The most frequent theme from the participants' beliefs about how children and youth develop ecological literacy reflected cultivating a deep awareness and sense of connection to one's place. This was especially true for the educators from First Light Charter School, who believe in cultivating not only a connection to the natural world but also to one's community and culture of reference. The second theme that was discussed most frequently was that of the need for students to spend time outdoors, which was the more central focus of the teachers from Northland Charter School. The difference in these top two beliefs about ecological literacy between the two groups of teachers is most likely explained by the age range that is served by each school. If one recalls the EID model, education *in* the environment (i.e. time spent outdoors in natural areas) happens earlier in a person's life than education *about* and *for* the environment (i.e. that which generates perceptions of connectedness and a deeper awareness of ecological principles) (Green et al., submitted for publication; Lucas, 1979).

The beliefs that connection to place and time spent outdoors are critical for a person to develop ecological literacy inspire specific methods that educators can employ in their teaching. Simply getting students outdoors, immersed in one way or another in the natural world was brought up many times by all of the participants as a necessary starting point. This is supported by Green et al.'s (submitted for publication) argument that a person must develop *trust in nature*

through consistent, positive interactions with the environment before the latter stages of EID can be nurtured. It is important to note that these experiences outdoors should be positive for students, and as the teachers from Northland Charter School pointed out, school-wide structures and management procedures for taking students outside should be developed to facilitate this process. Spending time outdoors has the potential to contribute to student engagement in instructional activities and help students to form emotional attachments to the natural world—both of which were also factors that the teachers discussed as contributing to the development of ecological literacy.

The other major theme, that of developing a sense of connection to the natural world, can similarly be nurtured through specific teaching methods such as those employed by the research participants. First and foremost, this theme encourages spending time outdoors in natural areas, which can help youth develop positive emotional bonds with their natural surroundings and a sense of connectedness. Second, as was emphasized in the literature, all educators should endeavor to make learning relevant to the lives of students—which the six participants strive to do on a daily basis—and real-world connections to curricula can make this possible (Goleman et al, 2012; Orr, 1992; Sobel, 2004). Place- and community-based education, as informed by a critical pedagogy of place, is rooted firmly in real-world experiences in local settings (Gruenewald, 2003, 2010; Smith, 2007; Sobel, 2004). This is also true for educational practices that are guided by traditions of local and Indigenous knowledge. It is the common ground of places that can bring together diverse ways of knowing and being and provide for justice in terms of human experience and presence in those places (Gruenewald, 2010; Greenwood, 2013).

A final theme that persisted throughout the research process was the role of LIK. The literature review made it clear that LIK must serve as a complement to Western knowledge traditions in school settings in order to best foster ecological literacy in children and youth (Barnhardt & Kawagley, 2005; Cajete, 2005, Goleman et al., 2012; Greenwood, 2013). The role of LIK was explicit in the findings from teachers at First Light Charter School, where it forms the basis of the school's mission. However, at a school such as Northland Charter School, where many teachers consider themselves "outsiders" in relation to Indigenous knowledge, this appears to be more of a challenge to integrate into the school setting (Brayboy & Deyhle, 2000). The teachers do still perceive that LIK is critical in order for their students to be ecologically literate, but finding ways in which to bring this into their teaching remains a hurdle.

I believe that encouraging collaborative efforts between these two schools, as an example, could go a long way towards bolstering *both* schools' efforts for ecological literacy and environmental citizenship. Perhaps older students from First Light could serve as mentors for the younger students at Northland—an exchange that could strengthen the older students' self-efficacy and confidence while simultaneously providing an older role model for the younger students. This system is already in place inside the walls of Northland, and it could be a natural extension outward, connecting students with the larger community. This would also encourage an exchange of knowledge across a wide range of experience, including those with Alaska Native heritage. Denise suggested an example of this type of collaboration during her interview, knowing that students at both schools tend school gardens and help to raise chickens.

Implications for Public Schooling in General

Through investigating the research questions with six teachers in two local public charter schools, this study has illuminated two key themes about how practicing teachers can foster ecological literacy in their students: 1) through positive experiences in the natural world, and 2) by making real-world connections to curricula in order to nurture a sense of awareness and connection to place. By sharing these themes with the greater educational community and providing evidence for the importance of place- and community-based education, other teachers in other schools can similarly strive to develop ecological literacy in youth. Through conducting the interviews and analyzing the data, it has become apparent that these teachers are well aware of the importance of using the local environment and community resources "to link what they are teaching to the everyday lives of the students" (Alaska DEED, 2012, p. 13). It is possible that these examples of culturally responsive teaching may be linked to the charter school contexts in which they occurred; however, that does not diminish the significance of the findings for educational settings of all types. The specific methods that many of these teachers employ to engage their students in relevant projects and experiential learning activities rooted in local contexts could be easily replicated in a wide range of schools and communities.

There are several important implications from this research for public schooling in general. The most critical is the need to move the type of educational experiences that foster ecological literacy in youth—referred to by many as environmental education—to a more central position in schools (Berkowitz et al., 2005; Goleman et al., 2012; Orr, 1992). This is something that has been done in a number of places, and it was a part of the criteria for choosing the two

charter schools included this study. Nonetheless, the research participants still referred frequently to the structural obstacles that the public school system presents in regard to fostering ecological literacy—issues such as standardized testing, funding, and outdoor equipment shortages. The reason that environmental education must move to a central position in public education is because it can create a culture within entire schools (or even districts) that is conducive for nurturing ecologically literate students. Teachers can collaborate, develop school-wide policies for taking students outdoors, and support one another in developing curricula grounded in the local setting. These are things that are happening at First Light and Northland Charter Schools.

As many authors have pointed out, local curricula are an absolute necessity for ecological literacy (Berkowitz et al., 2005; Goleman et al., 2012; Jordan et al., 2009; Orr, 1992), and Eric and Lucy both described how this was an essential aspect of laying the foundation for their schools. There are abundant examples of local, context-relevant curricula that can serve to guide educators and their advocates in developing materials for their own context (Goleman et al., 2012; Gruenewald & Smith, 2010; Henry-Stone, 2010; Smith & Williams, 1999; Sobel, 2004; Stephens, 2000; Stone & Barlow, 2005; Takano et al., 2009). In addition to the need to develop local curricula, it is also necessary to have a means by which to share these resources. An excellent example of a platform for sharing curricular resources for a specific context is the Alaska Native Knowledge Network (www.ankn.uaf.edu).

Partnerships between schools and community groups can also help to support educators in developing local curricula and building more extensive networks to improve their efforts for ecological literacy. Examples of such community groups include Native associations or tribal councils, environmental education organizations, and nonprofit organizations involved in issues of local sustainability and environmental action. These partnerships could serve to take pressure off of teachers to be experts in every aspect of ecological literacy and environmental citizenship, including LIK. By taking schools out into the community and vice versa, students are provided with limitless real-world connections and they are able to see the meaning and value of education. These types of partnerships can also turn one of the obstacles identified by a number of the research participants—teaching in an urban area—into an advantage.

Finally, pre- and in-service teacher training programs should make education for ecological literacy and environmental citizenship an explicit part of their agendas. None of the research participants identified these programs as having had a lasting impact on their practices regarding

ecological literacy, although it should be noted that all but one of the participants completed their initial teacher training more than a decade ago. Since these individuals finished their training, teacher education in certain schools of education has trended towards a greater emphasis on place- and community-based educational practices, particularly where several of the participants received their training (Gruenewald & Smith, 2010; Stone & Barlow, 2005; Vinlove, in press). All of the participants explained that they wished they had received more support in this area during their teacher training, and they expressed a desire to participate in ongoing professional development relevant to these pedagogical practices.

One useful addition to teacher training would be a study of the framework for environmental citizenship as well as the EID model (Berkowitz et al., 2005; Green et al., submitted for publication). Pre- and in-service teachers could learn teaching methods grounded in these theories. As all of the research participants expressed, ecological literacy begins with getting students outdoors and helping them to feel comfortable in the natural world. Therefore, teacher training needs to ensure that future teachers have these experiences as well and are properly prepared to facilitate this for their students. This means that schools of education and teacher certification must provide pre-service teachers with outdoor, experiential education opportunities, supporting them in developing the skills and dispositions to successfully guide their students in these same pursuits. As Vinlove (in press) explains, new teachers need support in learning how to gather knowledge from local sources, connecting place with academic content, and acquiring the practical skills for place-based teaching. Finally, educators must have the chance to develop a healthy environmental identity, rooted in trust in nature, spatial autonomy, environmental competency, and, ideally, environmental action. Without this foundation, it is not feasible to expect teachers to be capable of fostering ecological literacy and environmental citizenship in their students.

All of the research participants expressed their gratitude for the opportunity to discuss this topic and to reflect on their own practices as they pertain to the development of ecological literacy in students. Several teachers stated a concern that they are not doing all that they can to foster ecological literacy or a deeper understanding of local cultural foundations. However, I believe that an important role of mine as a researcher has been to reflect back to these individuals the excellent work they do every day in their teaching. Through analyzing the data from all six participants, it has emerged that several teachers may not perceive that their efforts carry great significance and meaning for their students. The unfortunate reality of the pace of contemporary

schooling often leaves teachers and administrators with insufficient time for self-reflection and peer observations to support one another in validating and building upon the effectiveness of their teaching practices. I am hopeful that this is one important contribution my research effort has made to the participants. The process of conducting this research and building relationships with local teachers has proven quite meaningful for me as well. All of the participants were provided with a copy of the final research paper and it was presented publicly, with the possibility for further presentations at the request of the participating schools.

Study Limitations and Future Research Considerations

I recognize that there are limitations to this study. The small sample size makes it difficult to generalize the results of the interviews and student work review to all educational situations, but they may be representative of similar contexts. The teacher participants only represent public charter schools, at the exclusion of the other public schools in the same district. However, I believe that the information and knowledge gained through this study carries significance for informing effective pedagogical methods in all educational contexts. Future study could explore these same questions in other public schools, including non-charter and rural schools, as well as programs and schools outside of the public education sphere. Exploring key insights from across a wide spectrum of educational settings could prove invaluable, revealing such features as administrative structures that support the development of ecological literacy.

Due to school district constraints for external research, I was not able to observe the teachers' practices during the students' school day, which also limited the amount and type of data that I was able to collect. The teachers themselves were more than willing to permit me to come to their classes, join the students on nature walks, and participate in whatever other ways would have been useful to the research. In the future, it would be beneficial to provide for this type of participant observation—to actually watch students immersed in education for ecological literacy. This would serve to validate the interview data as well, giving the researcher an opportunity to witness the teacher's methods in practice. Another benefit of conducting research during the school day would be the alleviation of difficulties finding time outside of the school day to meet with teachers.

Future research efforts should include ways in which to gauge ecological literacy as well as environmental citizenship across age levels and into adulthood. For example, the EID model could be applied in more studies to gain a better understanding of students' environmental identi-

ty development throughout their schooling (Green et al., submitted for publication). The long-term development of ecological literacy and environmental citizenship suggests that longitudinal studies are needed to track individuals' growth through various stages of development. I would recommend an effort to observe students from schools such as Northland and First Light, to determine if methods for ecological literacy employed by teachers in these settings did indeed nurture environmental citizens who participate actively in issues of sustainability and show concern for the natural world as adults. This could be similar to studies that Chawla (1999, 2006) has conducted but with a population who attended public schools with a focus on place- and community-based education for ecological literacy.

Finally, I believe that more research efforts are needed to examine the role of LIK in ecological literacy, especially in public school settings where educators may not view themselves as experts of these bodies of knowledge. This is a timely and necessary area of study, especially for place- and community-based education. It is through such efforts that decolonization and healing can take place as Indigenous history and presence are honored and given a position of prominence in education (Battiste, 2008; Greenwood, 2013).

Final Thoughts

In closing, I would like to share a final insight from Tewa educator, Gregory Cajete, who believes that education should be grounded in community and spirit. I believe it is the vision of educators like Cajete and Orr that can help to restore healthy social and environmental relationships as well as the recognition of interdependence. He writes:

> My sense as a Native educator is that education must now focus on the recovery of our biophilic sensibility and its nurturance in our children. The education of the twenty-first century must be about healing this cultural and ecological split. Healing this schizophrenia is not just the task of Indigenous education but the task of all education. Our essential educational task is that of reconnecting with our innate biophilia. It is the task of each of us to "Look to the Mountain!" and engender a vision of a sustainable future for all children. (Cajete, 1999, pp. 205-206)

I believe that the teachers from this study are indeed supporting students in recovering their "biophilic sensibility," and I am quite hopeful that the insights they have shared will serve to encourage other educators of all backgrounds to do the same. This research contributes to the growing body of evidence for the effectiveness of place- and community-based education, espe-

cially as it may foster ecological literacy in youth and serve to strengthen local communities. Common ground across diverse knowledge systems can be found in shared experiences of local places. As educators provide students with positive experiences in natural areas, especially at a young age, then it may become possible to cultivate a sense of trust in nature and healthy environmental identities. This in turn will increase ecological literacy and help to nurture generations of environmental citizens capable of making positive choices for a sustainable future.

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Appendix A

University of Alaska Fairbanks IRB Approval Letter

(907) 474-7800
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uaf-irb@alaska.edu
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Institutional Review Board

909 N Koyukuk Dr. Suite 212, P.O. Box 757270, Fairbanks, Alaska 99775-7270

April 24, 2014

To:	Amy Vinlove, PhD Principal Investigator
From:	University of Alaska Fairbanks IRB
Re:	[595440-1] Fostering Ecological Literacy in Two Public Charter Schools

Thank you for submitting the New Project referenced below. The submission was handled by Exempt Review. The Office of Research Integrity has determined that the proposed research qualifies for exemption from the requirements of 45 CFR 46. This exemption does not waive the researchers' responsibility to adhere to basic ethical principles for the responsible conduct of research and discipline specific professional standards.

Title:	Fostering Ecological Literacy in Two Public Charter Schools
Received:	April 18, 2014
Exemption Category:	2
Effective Date:	April 24, 2014

This action is included on the May 7, 2014 IRB Agenda.

Prior to making substantive changes to the scope of research, research tools, or personnel involved on the project, please contact the Office of Research Integrity to determine whether or not additional review is required. Additional review is not required for small editorial changes to improve the clarity or readability of the research tools or other documents.

Appendix B

Recruitment Letter to School Principals

August 15th, 2014

To Whom It May Concern:

I am a master's degree student at the University of Alaska Fairbanks and I am completing research on 'ecological literacy' in local public charter schools under the guidance of Dr. Amy Vinlove (School of Education). In short, ecological literacy is an individual's understanding of ecological and biological systems and how humans interact with these systems. I'm especially interested in exploring this concept at your school because of your stated mission to empower students through instructional models that are grounded in local knowledge and the cultural contexts for knowing.

I wanted to reach out to you about the possibility of interviewing two or three interested teachers from your school next fall. I would enjoy the opportunity to explore this question with them, and I hope it can be a time of refiection for the teachers and a way to explore new possibilities for their teaching. As a former high school science teacher myself, I know that I always benefited from reflecting and discussing ideas with other educators.

These interviews should only take about one hour per teacher and this should be the only time constraint for them. At the same time, I am hoping to take a look at a few examples of relevant student work and class projects. If examples of student work are included in any publications, all student names and identifying characteristics will be removed to ensure student confidentiality. I'd be aiming to conduct these interviews sometime between mid-September and mid-November, and I will work around each teacher's schedule to make sure it is a convenient time for them--after school, for instance. I will not be studying youth directly in this research, and so these interviews can take place outside of the school day.

The risks to the interview participants are minimal, as their identities will not be connected to their responses. When transcribing the interviews I will use pseudonyms, and when analyzing and presenting the data I will use pseudonyms and refer to individuals with broad descriptive terms (e.g. "a secondary teacher in a local public charter school.") If examples of student work are included in any publications, all student identifiers will be removed as well.

Thank you in advance for your support and let me know if you have any questions. You can reach me via phone at 907-474-5652 or email at epsterling@alaska.edu.

Sincerely,

Evan Sterling

Appendix C

Informed Consent Form for Interview Participants

IRB # 595440-1
Date Approved: April 24, 2014

My name is Evan Sterling and I am a master's degree student at the University of Alaska Fairbanks and I am completing research on ecological literacy in public charter schools. I am working under the guidance of Dr. Amy Vinlove (School of Education) at UAF. Thank you for agreeing to participate in this interview.

Description of the Study:
You are being asked to take part in a research study about ecological literacy in the public charter school setting. My specific research questions are *"How is ecological literacy fostered in two local public charter schools? What are the perceptions of teachers in these schools about how youth develop this type of literacy? What specific methods are these teachers employing to develop ecological literacy in their students?"* You are being asked to take part in this study because of your role as a teacher in a public charter school. Please read this form carefully. You are invited to ask any questions you may have now or at any time during your participation.

If you decide to take part, you will be asked to respond to a series of open-ended questions relating to your work as a school teacher and how it may contribute to environmental awareness, or ecological literacy, in your students. I would also like to collect photographed examples of student work or classroom artifacts that may be pertinent to this research investigation. All student identifiers will be removed to ensure student confidentiality. In total, this interview and exploration of other relevant materials should take no more than one and a half hours.

Risks and Benefits of Being in the Study:
The risks to you if you take part in this study are minimal as your identity will not be connected to your responses. When transcribing the interviews I will use pseudonyms, and when analyzing and presenting the data I will use pseudonyms and refer to individuals with broad descriptive terms (e.g. "an elementary teacher in a local public charter school.") If examples of student work are included in any publications, all student names and identifying characteristics will be removed. There are no direct benefits to you for agreeing to participate in the discussion, although your voice will contribute to the overall knowledge base on the development of ecological literacy in youth and hopefully provide ideas for strengthening teaching practices in this area.

Confidentiality:
The data derived from this study may be used in reports, presentations, and publications but you will not be individually identified. The audio recordings of our discussion and all photographs of student work will be deleted after the transcription occurs, and the transcriptions will not contain actual names of teachers or students.

Voluntary Nature of the Study:
Your decision to take part in the study is voluntary. You are free to choose whether or not to take part in the study. If you decide to take part in the study you can stop at any time or change your mind and ask to be removed from the study. No matter what you decide, now or later, nothing will happen to you as a result.

Contacts and Questions:
If you have questions now, feel free to ask me. If you have questions later, you may contact me at epsterling@alaska.edu or 474-5652. You may also contact the principal investigator, Amy Vinlove, at alvinlove@alaska.edu or 474-1759.

If you have questions or concerns about your rights as a research participant, you can contact the UAF Office of Research Integrity at 474-7800 (Fairbanks area) or 1-866-876-7800 (toll-free outside the Fairbanks area) or uaf-irb@alaska.edu.

Statement of Consent:
I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study. I am 18 years old or older. I have been provided a copy of this form.

Signature of Participant & Date	Signature of Person Obtaining Consent & Date

Appendix D

Interview Protocol

Ecological Literacy in Two Public Charter Schools

Research Questions: ***"How is ecological literacy fostered in two local public charter schools? What are the perceptions of teachers in these schools about how youth develop this type of literacy? What specific methods are these teachers employing to develop ecological literacy in their students?"***

Ecological literacy, a term made popular by David Orr, is used to describe one's ability to understand the basic principles of ecology and the natural systems which make life on earth possible and to live according to those principles. I would like to explore this topic with you in an open-ended interview format, allowing space for reflection on your current teaching practices as they pertain to this concept of ecological literacy. I greatly appreciate your thoughtful and honest responses and welcome feedback on this process as well. Our conversation will probably take about an hour, and I hope this will also include time to examine relevant examples of student work and classroom projects or activities. I will be recording the conversation in order to transcribe it at a later time *(explain and sign CONSENT FORM)*.

1. Let's begin by having you tell me a little bit about your background as it relates to your work as a charter school teacher. . . How did you end up teaching at the school you are now working at? What drew you to a school with a focus on local knowledge and place?

2. I provided a definition of "ecological literacy" from David Orr, an educator who coined the term. But I would like to know, how would *you* define ecological literacy?

3. Do you personally think it is a) **useful** b) **important** or c) **essential** for a person to develop a high level of ecological literacy? Why?

4. **How do you think youth develop ecological literacy?** How did you?

5. How much planning do you do for science or ecology lessons and units? Do you provide opportunities for your students' interests and curiosities to guide these lessons?

6. **What specific methods do you employ to develop ecological literacy in your students**?

7. What are some ways that educators can assess ecological literacy? What do these assessments tell you about your students' ecological literacy and how it develops over time? **Do think there is a connection between a high level of ecological literacy and overall academic and personal success for your students?**

8. Do you believe a person's cultural background and values influence their development of ecological literacy? What are some methods you could use as a teacher to account for cultural differences among your students, specifically with regard to ecological literacy?

9. What aspects of ecological literacy learning lend themselves best to formal school settings and which are better done experientially?

10. Do you feel that you do an a) **okay** b) **solid** or c) **outstanding** job of **fostering ecological literacy in your students?** What do you think you could do better?

Appendix E

Student Work Review Protocol

Ecological Literacy in Two Public Charter Schools

Research Questions: ***"How is ecological literacy fostered in two local public charter schools? What are the perceptions of teachers in these schools about how youth develop this type of literacy? What specific methods are these teachers employing to develop ecological literacy in their students?"***

In addition to conducting semi-structured interviews to address these research questions, I will also be examining examples of relevant student work and classroom projects to gain a better understanding of how ecological literacy is developed in students. As with the interviews, this document analysis will happen entirely outside of the students' school day. In order to adequately examine and analyze these documents, I will take digital photographs of them after obtaining permission from the teacher (included on the Consent Form). If examples of student work are included in any publications, all student identifiers will be removed to ensure confidentiality. These photographs, along with the audio recordings from the interviews, will be saved on a password-protected jump drive that will be locked in the office of the Principal Investigator, Amy Vinlove, in Gruening 707B. After transcription occurs, these electronic documents will be permanently deleted.